Series PM175 Powermeter and Power Quality Analyzer

Installation and Operation Manual

BG0415 Rev. A2

LIMITED WARRANTY

The manufacturer offers the customer a 24-month functional warranty on the instrument for faulty workmanship or parts from date of dispatch from the distributor. In all cases, this warranty is valid for 36 months from the date of production. This warranty is on a return to factory basis.

The manufacturer does not accept liability for any damage caused by instrument malfunction. The manufacturer accepts no responsibility for the suitability of the instrument to the application for which it was purchased.

Failure to install, set up or operate the instrument according to the instructions herein will void the warranty.

Only a duly authorized representative of the manufacturer may open your instrument. The unit should only be opened in a fully anti-static environment. Failure to do so may damage the electronic components and will void the warranty.

The greatest care has been taken to manufacture and calibrate your instrument. However, these instructions do not cover all possible contingencies that may arise during installation, operation or maintenance, and all details and variations of this equipment are not covered by these instructions.

For additional information regarding installation, operation or maintenance of this instrument, contact the manufacturer or your local representative or distributor.

WARNING

Read the instructions in this manual before performing installation, and take note of the following precautions:

- **Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the instrument. Failure to do so may result in serious or even fatal injury and/or equipment damage.**
- **Before connecting the instrument to the power source, check the labels on the back of the instrument to ensure that your instrument is equipped with the appropriate power supply voltage, input voltages and currents.**
- **Under no circumstances should the instrument be connected to a power source if it is damaged.**
- **To prevent potential fire or shock hazard, do not expose the instrument to rain or moisture.**
- **The secondary of an external current transformer must never be allowed to be open circuit when the primary is energized. An open circuit can cause high voltages, possibly resulting in equipment damage, fire and even serious or fatal injury. Ensure that the current transformer wiring is secured using an external strain relief to reduce mechanical strain on the screw terminals, if necessary.**
- **Only qualified personnel familiar with the instrument and its associated electrical equipment must perform setup procedures.**
- **Do not open the instrument under any circumstances when it is connected to a power source.**
- **Do not use the instrument for primary protection functions where failure of the device can cause fire, injury or death. The instrument can only be used for secondary protection if needed.**

Read this manual thoroughly before connecting the device to the current carrying circuits. During operation of the device, hazardous voltages are present on input terminals. Failure to observe precautions can result in serious or even fatal injury or damage to equipment.

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Chapter 1 General Information

The PM175 is a compact, multi-function, three-phase AC powermeter and power quality analyzer specially designed to meet the requirements of users ranging from electrical panel builders to substation operators.

Bright 3-row LED display provides easy local meter readings. The display module is freely detachable and can be located at a distance of up to 1000 meters from the device.

Two communication ports allow local and remote automatic meter readings and setup though the supplemental communication or user data acquisition software. Different communication options are available for remote communications with the meter including public telephone lines, LAN and the Internet.

Features:

- 3 voltage and 3 current transformer-isolated AC inputs for direct connection to power line or via potential and current transformers
- Multi-function 3-phase meter (true RMS, volts, amps, power, power factor, neutral current, voltage and current unbalance, frequency)
- Embedded harmonic analyzer, voltage and current THD, current TDD and K-Factor, inter-harmonics THD, up to 50th order harmonic
- Voltage and current harmonic spectrum and angles
- Ampere/Volt/THD/TDD demand meter
- Class 0.2 four-quadrant energy meter
- Time-of-Use (TOU), 8 totalization and tariff energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day, easy programmable tariff schedule
- Automatic daily profile for energy and maximum demand readings (total and tariff registers)
- Embedded programmable controller; 16 control setpoints; programmable thresholds and delays; relay output control; 1/2-cycle response time
- Event recorder for logging internal diagnostics events, control events and I/O operations

- 16 data recorders; programmable data logs on a periodic basis and on any internal and external trigger
- Two waveform recorders; simultaneous 6-channel AC recording in a single plot; sampling rate of 32, 64 and 128 samples per cycle; 20 pre-fault cycles; up to 30 seconds of continuous recording at a rate of 32 samples per cycle
- EN50160 Power Quality recorder (EN50160 compliance statistics, EN50160 harmonics survey statistics, onboard power quality analyzer; programmable thresholds and hysteresis; ready-for-use reports)
- Real-time waveform capture and monitoring; simultaneous 6-channel 4-cycle capture at 128 samples per cycle
- Easy to read 3-row (2x4 characters + 1x6 characters) bright LED display, adjustable update time, auto-scroll option with adjustable page exposition time, auto-return to a default page
- LED bar graph showing percent load with respect to user-definable nominal load current
- Detachable display module with a 3-wire RS-485 interface; up to 1000 meters operation
- 2 digital inputs for monitoring external contacts, and receiving pulses from energy, water and gas meters
- 2 relay outputs for alarms and controls, and for output energy pulses
- 2 optional optically isolated analog outputs with an internal power supply; options for 0-20mA, 4-20mA, 0-1mA, and ± 1mA output
- 2 optional optically isolated analog inputs with an internal power supply; options for 0-20mA, 4-20mA, 0-1mA, and ± 1mA input
- 50/60 Hz operation
- Precise internal clock with battery backup
- 1 Mbyte RAM with battery backup for long-term data and waveform recording
- Two communication ports; communications options available:

  COM1:

  RS-232/RS-422/RS-485

  56K Dial-up modem

  Ethernet 10/100BaseT, eXpertPower™ enabled

  COM2:

  RS-422/RS-485
- Modbus RTU, Modbus ASCII and Modbus/TCP communication protocols
- Easy field upgrading device firmware through any communication port

Measured Parameters

Parameter	Display	Comm.	Analog	Pulse	Alarm
1-cycle Real-time Measurements					
RMS Voltage per phase		✓	✓		✓
RMS Current per phase		✓	✓		✓
kW per phase		✓			✓
kvar per phase		✓			✓
kVA per phase		✓			✓
Power Factor per phase		✓			✓
Total kW		✓	✓		✓
Total kvar		✓	✓		✓
Total kVA		✓	✓		✓
Frequency		✓	✓		✓
Neutral Current		✓	✓		✓
Total Power Factor		✓	✓		✓
Voltage & Current unbalance		✓			✓
1-sec Average Measurements					
RMS Voltage per phase	✓	✓	✓		✓
RMS Current per phase	✓	✓	✓		✓
kW per phase	✓	✓			✓
kvar per phase	✓	✓			✓
kVA per phase	✓	✓			✓
Power Factor per phase	✓	✓			✓
Total kW	✓	✓	✓		✓
Total kvar	✓	✓	✓		✓
Total kVA	✓	✓	✓		✓
Total Power Factor	✓	✓	✓		✓
Frequency	✓	✓	✓		✓
Neutral Current	✓	✓	✓		✓
Voltage & Current unbalance	✓	✓			✓
Amps & Volt Demands					
Ampere & Volt Demand per phase		✓			✓
Ampere Maximum Demand per phase	✓	✓			✓
Voltage Maximum Demand per phase	✓	✓			✓
Power Demands					
kW Accumulated Demand Import & Export		✓	✓		✓
kvar Accumulated Demand Import & Export		✓	✓		✓
kVA Accumulated Demand		✓	✓		✓
kW Demand Import & Export		✓			✓
kvar Demand Import & Export		✓			✓
kVA Demand		✓			✓
kW Sliding Demand Import & Export		✓			✓
kvar Sliding Demand Import & Export		✓			✓
kVA Sliding Demand		✓			✓
kW Predicted Demand Import & Export		✓			✓
kvar Predicted Demand Import & Export		✓			✓
kVA Predicted Demand		✓			✓
kW Maximum Demand Import	✓	✓			
kW Maximum Demand Export		✓			
kvar Maximum Demand Import	✓	✓			
kvar Maximum Demand Export		✓			
kVA Maximum Demand	✓	✓			
Total Energy					
Total kWh Import & Export	✓	✓		✓	
Total kvarh Import & Export	✓	✓		✓	
Total kvarh Net		✓			
Total kVAh	✓	✓		✓	
Energy per Phase					
kWh Import per phase	✓	✓			
kvarh Import per phase		✓			
kVAh per phase	✓	✓			
TOU Registers					
8 TOU energy registers (kWh and kvarh import & export, kVAh, 2 pulse sources)	✓	✓			
8 TOU maximum demand registers		✓			
8 tariffs, 4 seasons x 4 types of day		✓			✓

Parameter	Display	Comm.	Analog	Pulse	Alarm
Harmonic Measurements					
Voltage THD per phase	✓	✓	✓		✓
Current THD per phase	✓	✓	✓		✓
Current TDD per phase	✓	✓	✓		✓
K-factor per phase	✓	✓	✓		✓
Voltage harmonics per phase up to order 50	✓	✓			
Current harmonics per phase up to order 50	✓	✓			
Voltage harmonic angles up to order 50		✓			
Current harmonic angles up to order 50		✓			
Fundamental Component					
Voltage and Current per phase		✓			
kW, PF per phase	✓	✓			
kvar, KVA per phase		✓			
Total kW, PF	✓	✓			
Total kvar, KVA		✓			
Min/Max Logging					
Min/Max A, V, total kW, kvar, kVA, PF	✓	✓			
Min/Max Frequency, Neutral current	✓	✓			
Min/Max THD, TDD, K-Factor per phase		✓			
Phase Rotation	✓				✓
Voltage and Current Phase Angles	✓	✓			
Day and Time	✓	✓			✓
Pulse Counters	✓	✓			✓
Analog Inputs (optional)	✓	✓			✓
Digital Inputs	✓	✓			✓
Relay Outputs	✓	✓			✓
Remote Relay Control		✓			
Alarm Triggers/Setpoints		✓			✓
Self-diagnostics		✓			

Chapter 2 Installation

Mechanical Installation

Panel Mounting

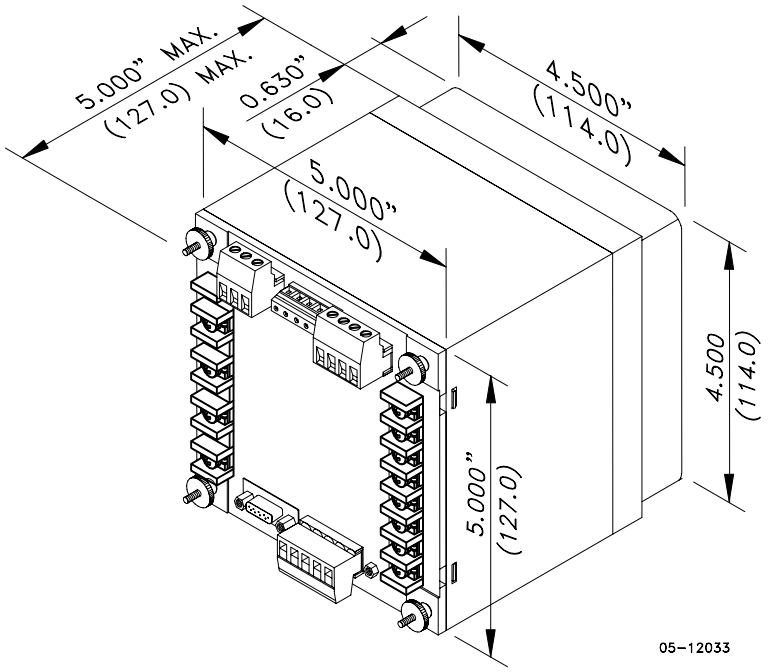


Figure 2-1 Dimensions

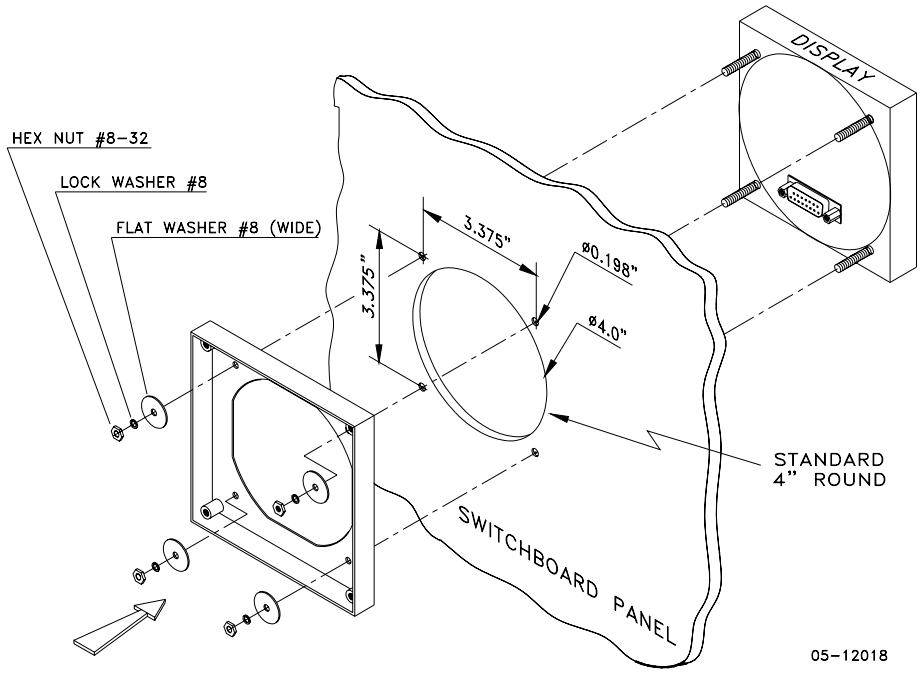


Figure 2-2 STEP 1 (ANSI 4" round cutout): Mount the display module in cutout

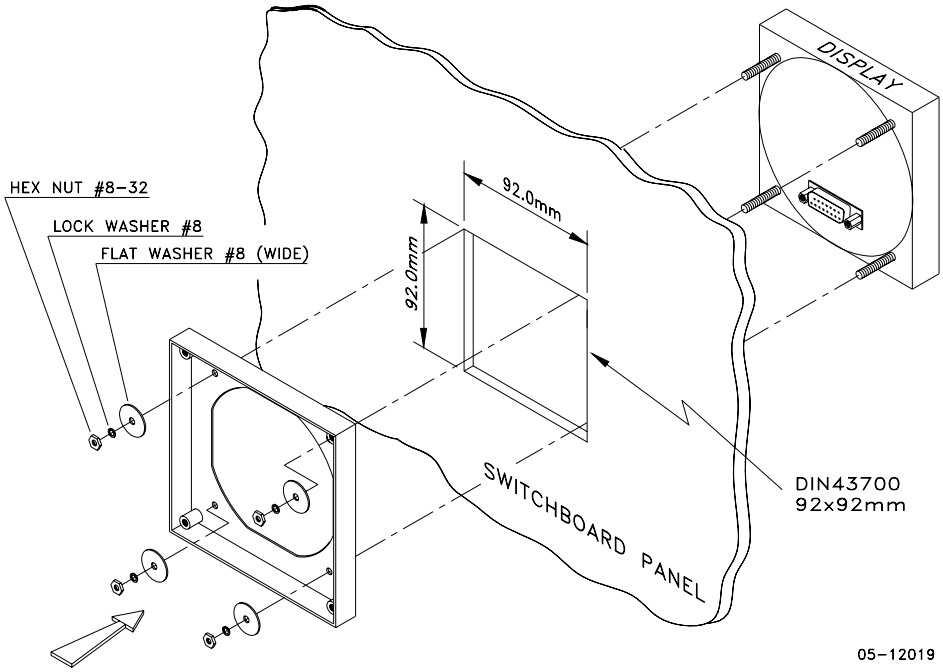


Figure 2-3 STEP 1 (DIN 92x92mm square cutout): Mount the display module in cutout

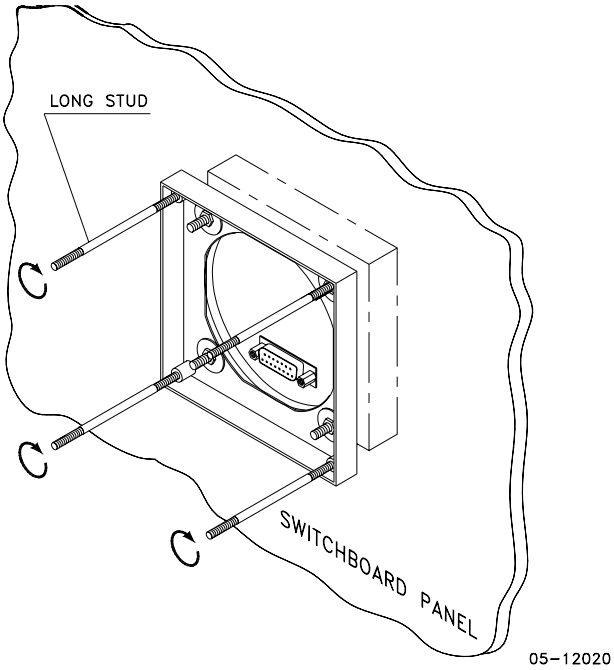


Figure 2-4 STEP 2: Assemble the four locating studs

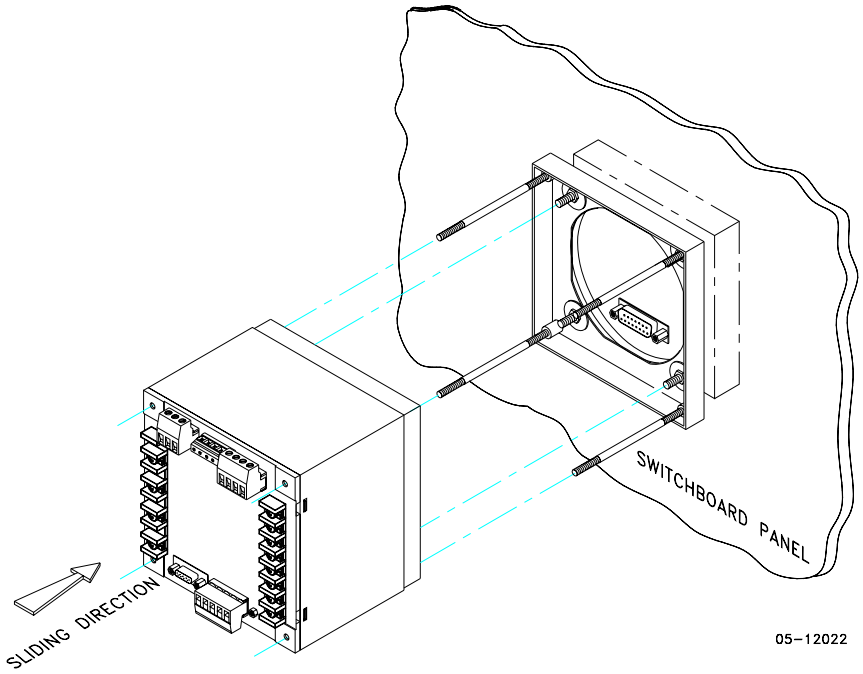


Figure 2-5 STEP 3: Slide and position the meter on locating studs

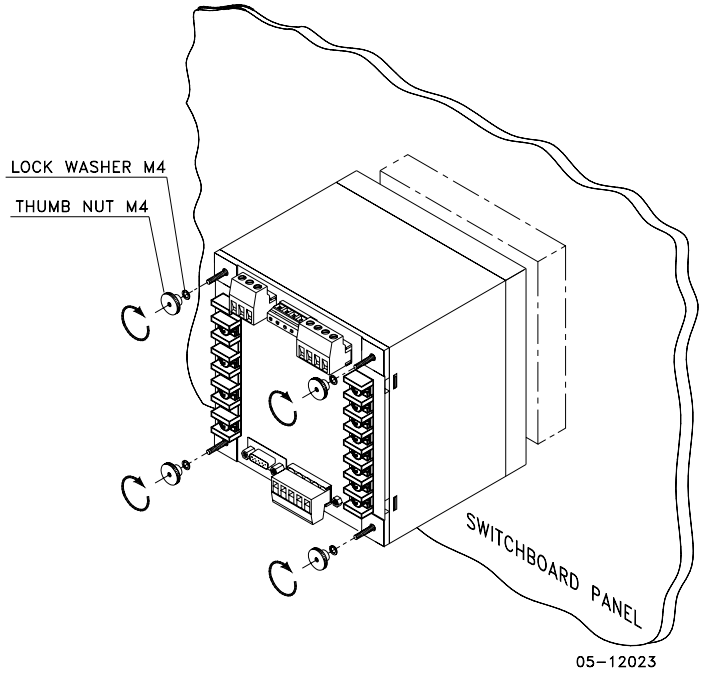


Figure 2-6 STEP 4: Affix the meter using the thumb nuts

DIN Rail Mounting

The PM175 can be mounted on a 35-mm DIN rail. The display module is mounted separately on the switchboard panel and is connected to the meter by a communication cable (see Remote Display Installation).

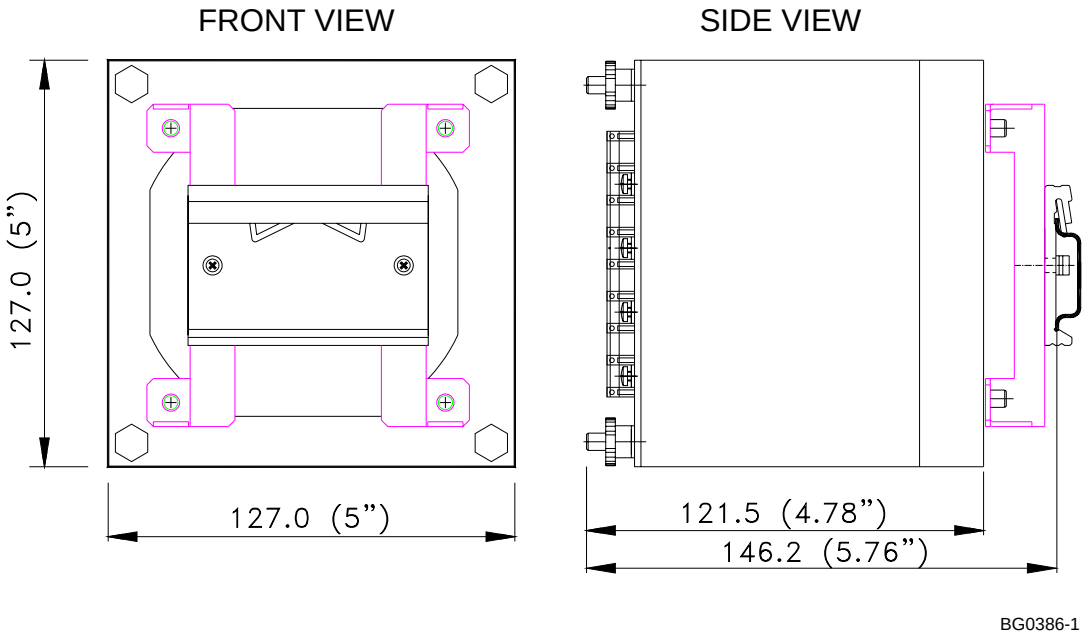


Figure 2-7 Dimensioons

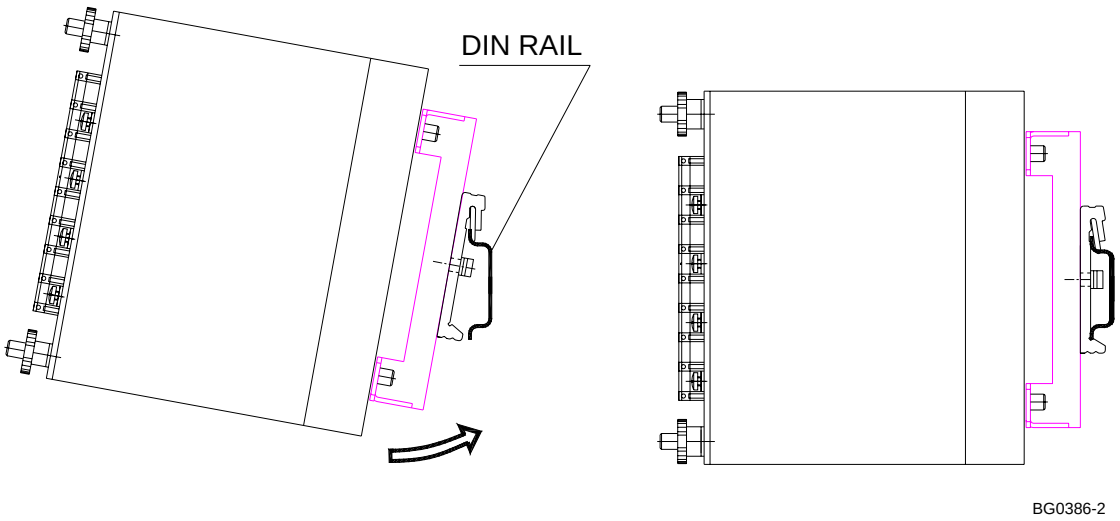


Figure 2-8 DIN rail mounting

Remote Display Installation

Mechanical Installation

Standard Cutouts

(ANSI 4" round or DIN 92x92 mm square)

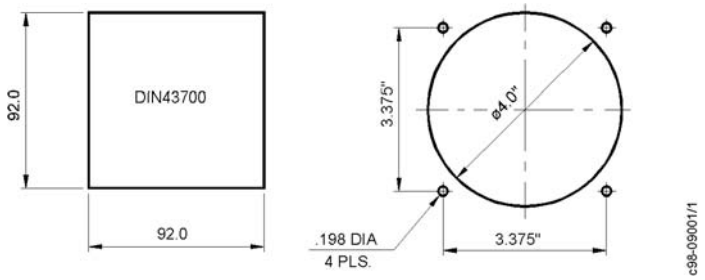
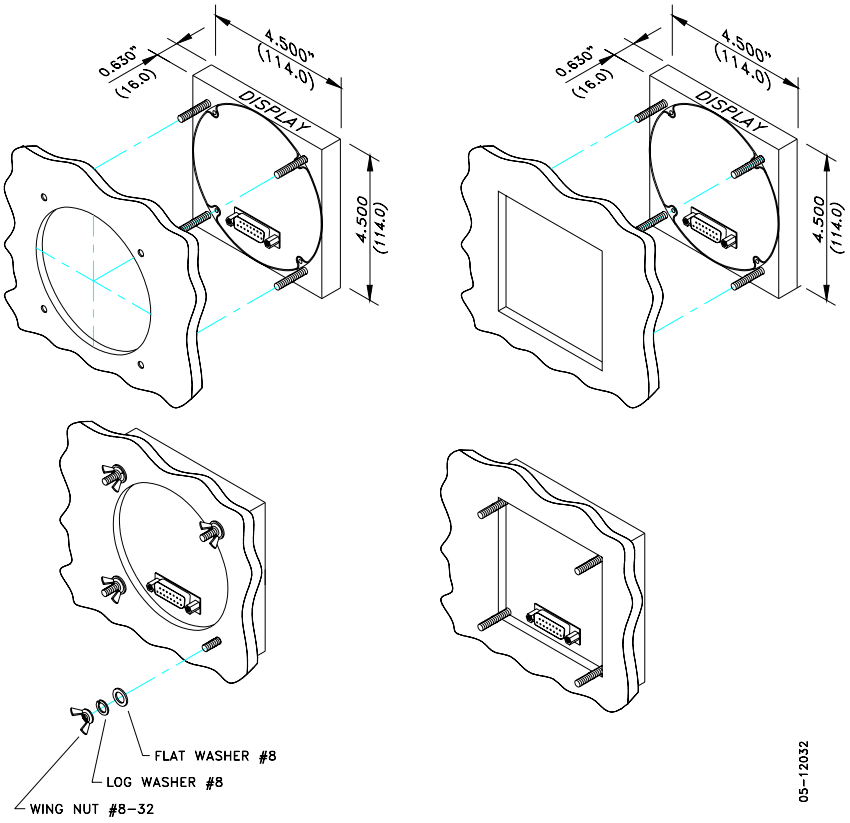


Figure 2-9 Display cutout dimensions



STEP 1: Insert the display module into cutout.
STEP 2: Fasten washers and nut on screws.

Figure 2-10 ANSI 4" or DIN 92x92 mm display mounting

Special Cutout

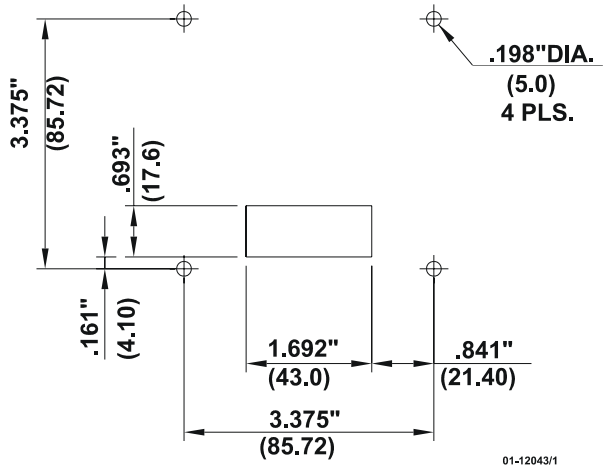


Figure 2-11 Panel cutout dimensions

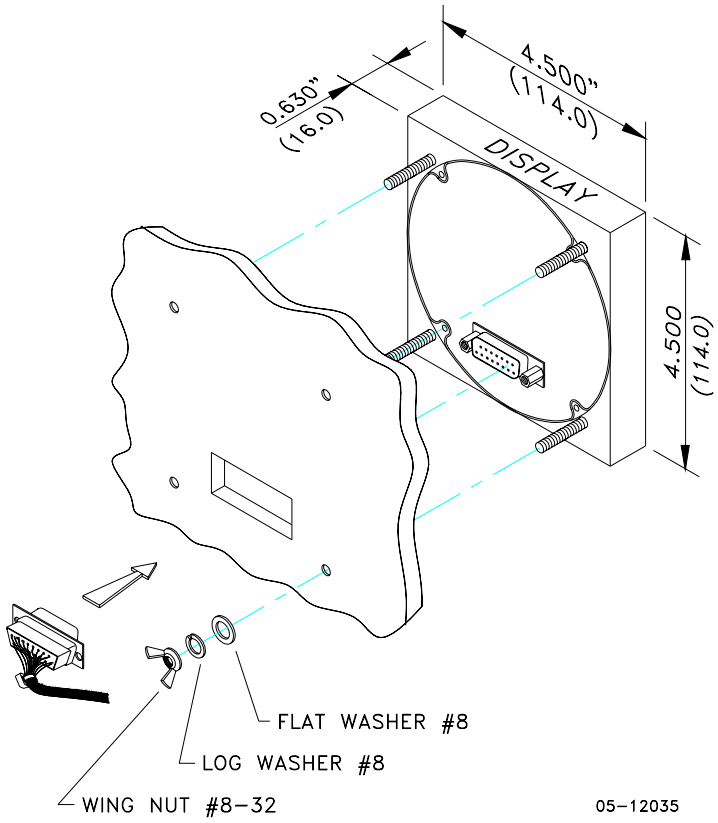


Figure 2-12 Display mounting

Electrical Connection

The remote display is connected to the meter via a 3-wire or 5-wire communication cable provided with two 15-pin D-type connectors.

At distances of up to 100 m, the display receives power through the communication cable directly from the meter. Connect pins 1 and 8 on both sides as shown in Figure 2-13.

At distances above 100 m, supply power from a separate 12V DC power source (a 12V AC/DC adapter can be used). Connect the positive wire to pin 1 and the negative wire to pin 8 as shown in Figure 2-14.

Pin	Signal
1	+12V
5	RS-485 + (plus)
7	RS-485 – (minus)
8	GND
15	Chassis ground

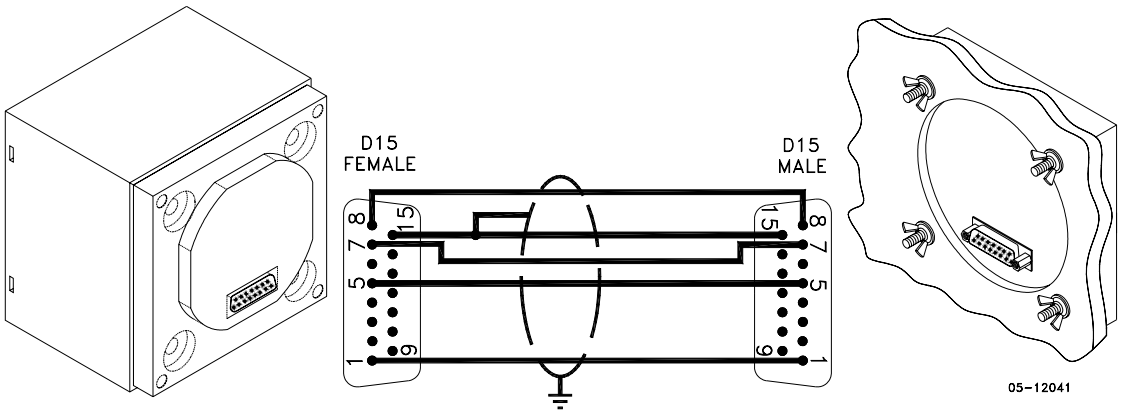


Figure 2-13 Self-powered remote display connection

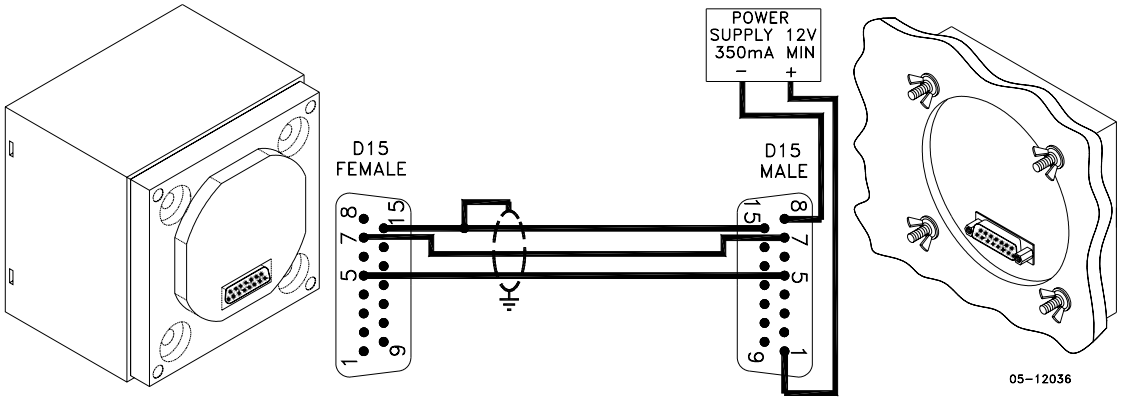


Figure 2-14 Remote display powered from a 12V DC power source

Electrical Installation

Before installation ensure that all incoming power sources are shut OFF. Failure to observe this practice can result in serious or even fatal injury and damage to equipment.

Typical Installation

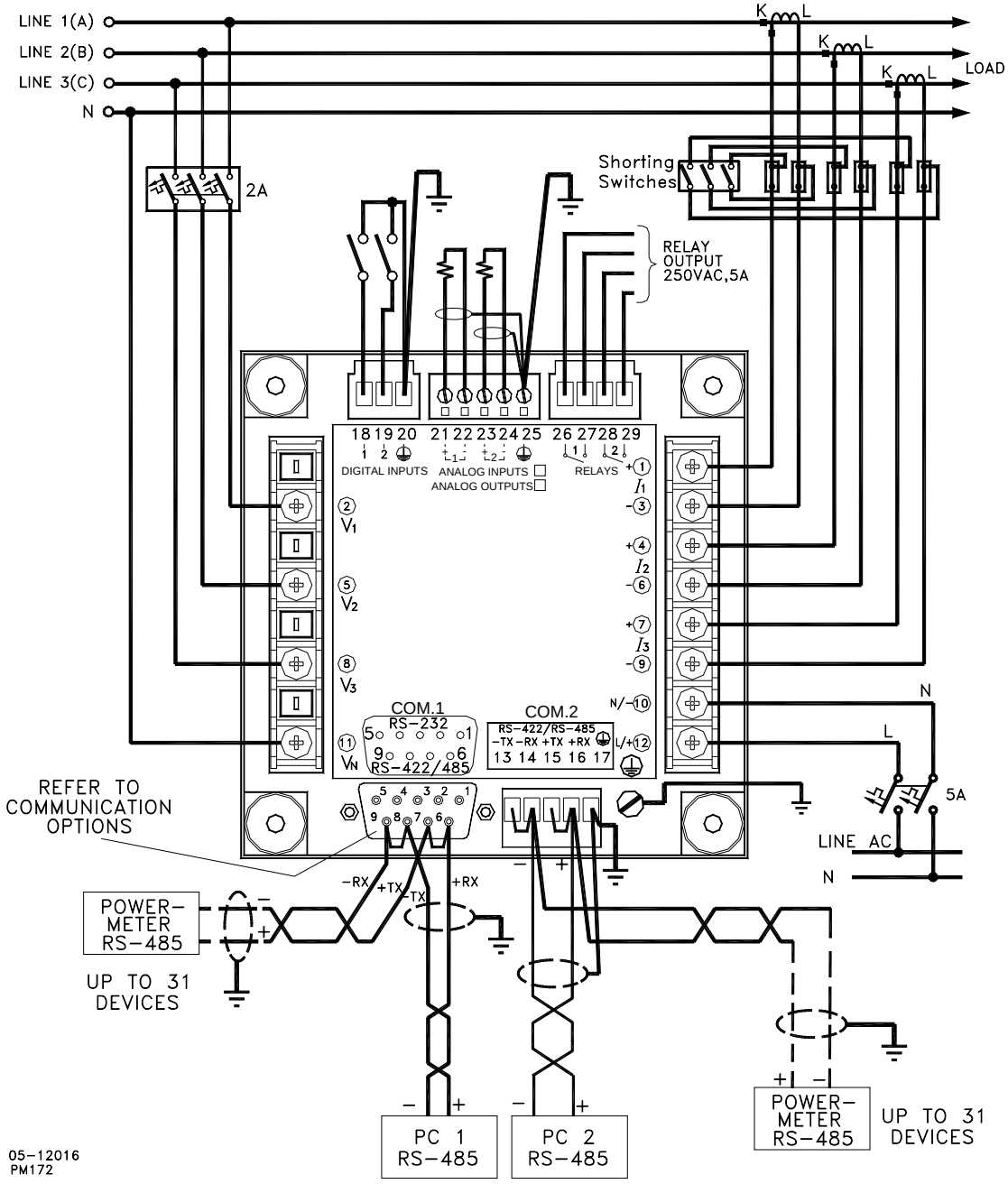


Figure 2-15 Typical Installation

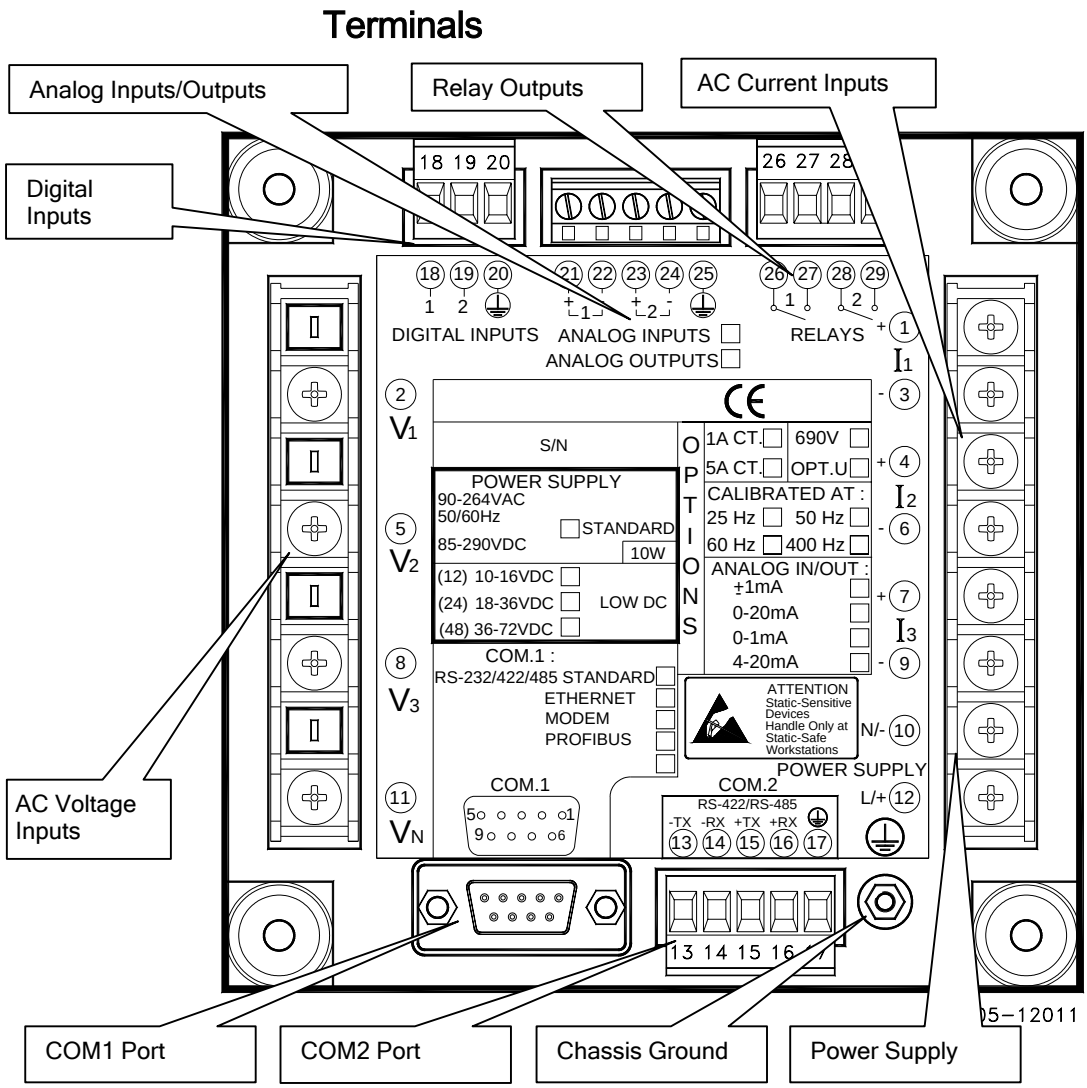


Figure 2-16 Terminals - Rear View

Power Source Connection

Before connecting your meter to the power source, check the label on the back of the device to ensure that it is equipped with the appropriate power supply.

The power source can be dedicated-fused, or from a monitored voltage if it is within the instrument power supply range.

AC power supply: connect the line wire to terminal 12 and the neutral wire to terminal 10.

DC power supply: connect the positive wire to terminal 12 and the negative wire to terminal 10.

Chassis Ground Connection

Connect the chassis ground of the device to the switchgear earth ground using a dedicated wire greater than 2 mm^2/14 AWG.

Wiring Diagrams

For AC input ratings, see “Technical Specifications” in Appendix A.

The following wiring configurations are available in the meter:

Wiring Configuration (See Basic Device Settings in Chapter 3)	Setup Code	Figure
3-wire 2-element Direct connection using 2 CTs	3dir2	2-17
4-wire Wye 3-element direct connection using 3 CTs	4Ln3 or 4LL3	2-18
4-wire Wye 3-element connection using 3 PTs, 3 CTs	4Ln3 or 4LL3	2-19
3-wire 2-element Open Delta connection using 2 PTs, 2 CTs	3OP2	2-20
4-wire Wye 2½ -element connection using 2 PTs, 3 CTs	3Ln3 or 3LL3	2-21
3-wire 2½ -element Open Delta connection using 2 PTs, 3 CTs	3OP3	2-22
4-wire 3-element Delta direct connection using 3 CTs	4Ln3 or 4LL3	2-23
3-wire 2½-element Broken Delta connection using 2 PTs, 3 CTs	3bLn3 or 3bLL3	2-24

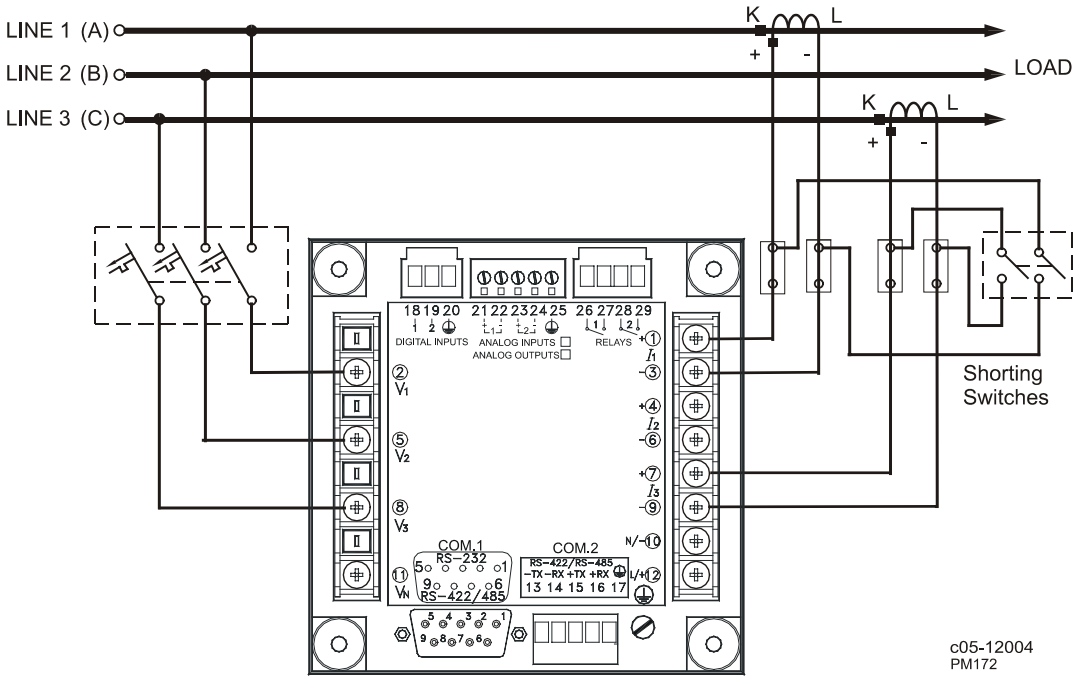


Figure 2-17 3-Wire 2-Element Direct Connection Using 2 CTs.

Wiring Mode = 3dir2

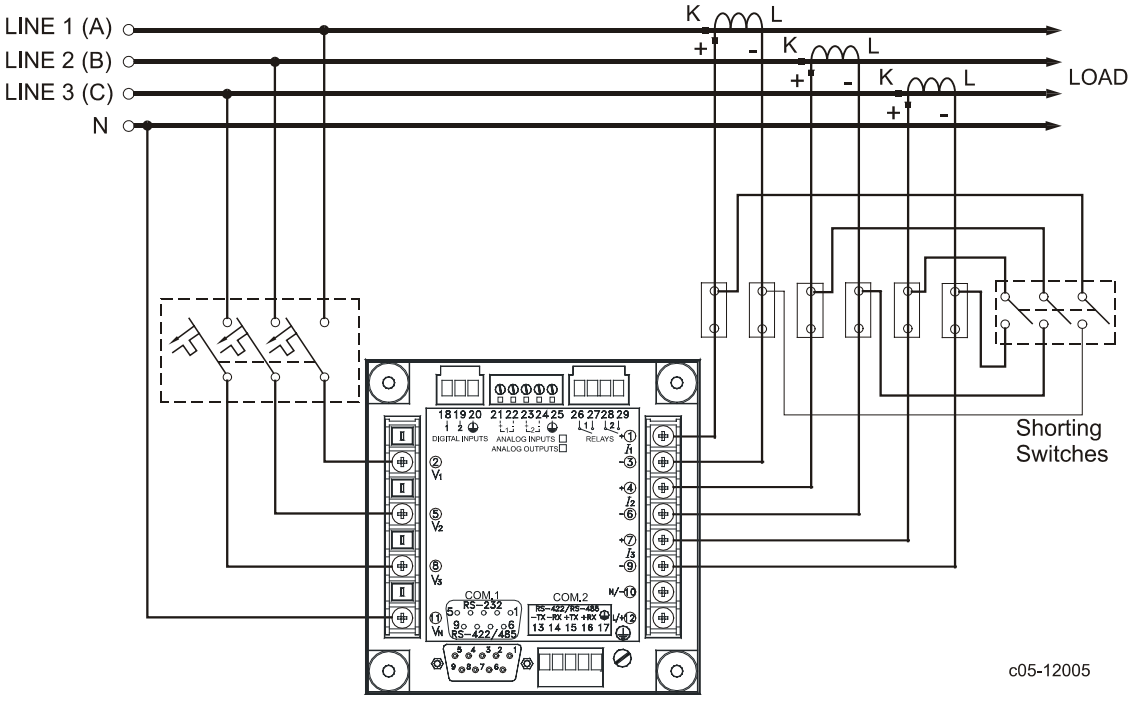


Figure 2-18 4-Wire Wye 3-Element Direct Connection Using 3 CTs.

Wiring Mode = 4LL3 or 4Ln3

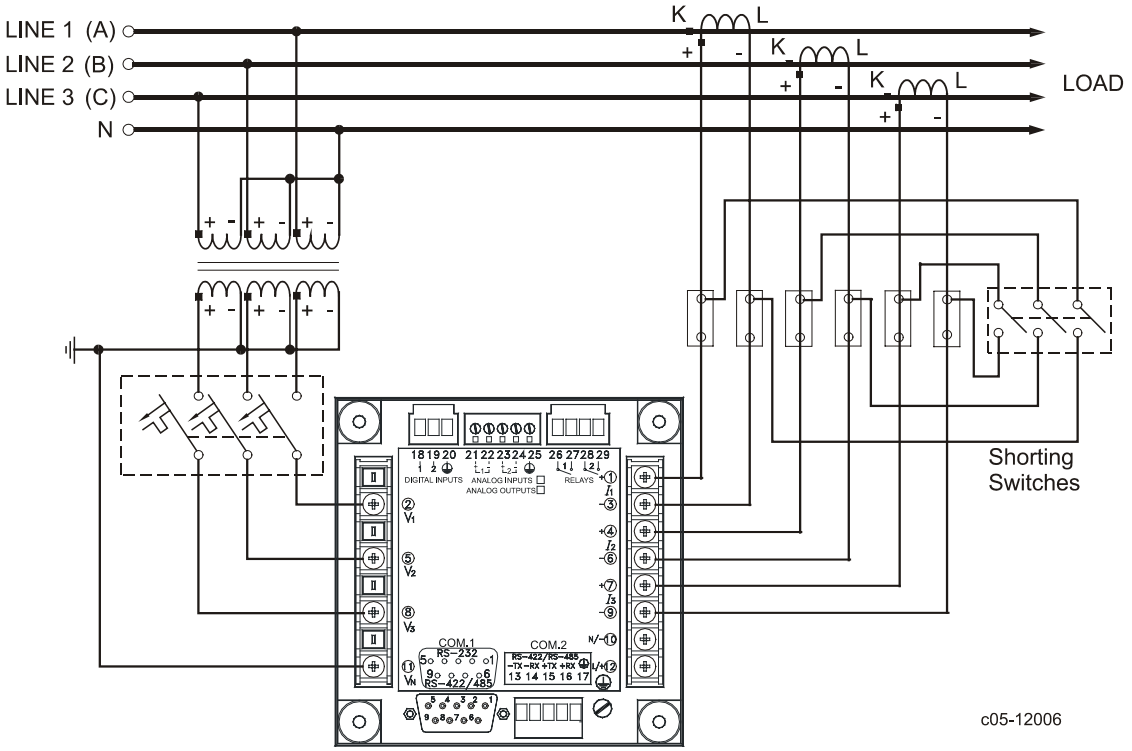


Figure 2-19 4-Wire Wye 3-Element Connection Using 3 PTs, 3 CTs.

Wiring Mode = 4LL3 or 4Ln3

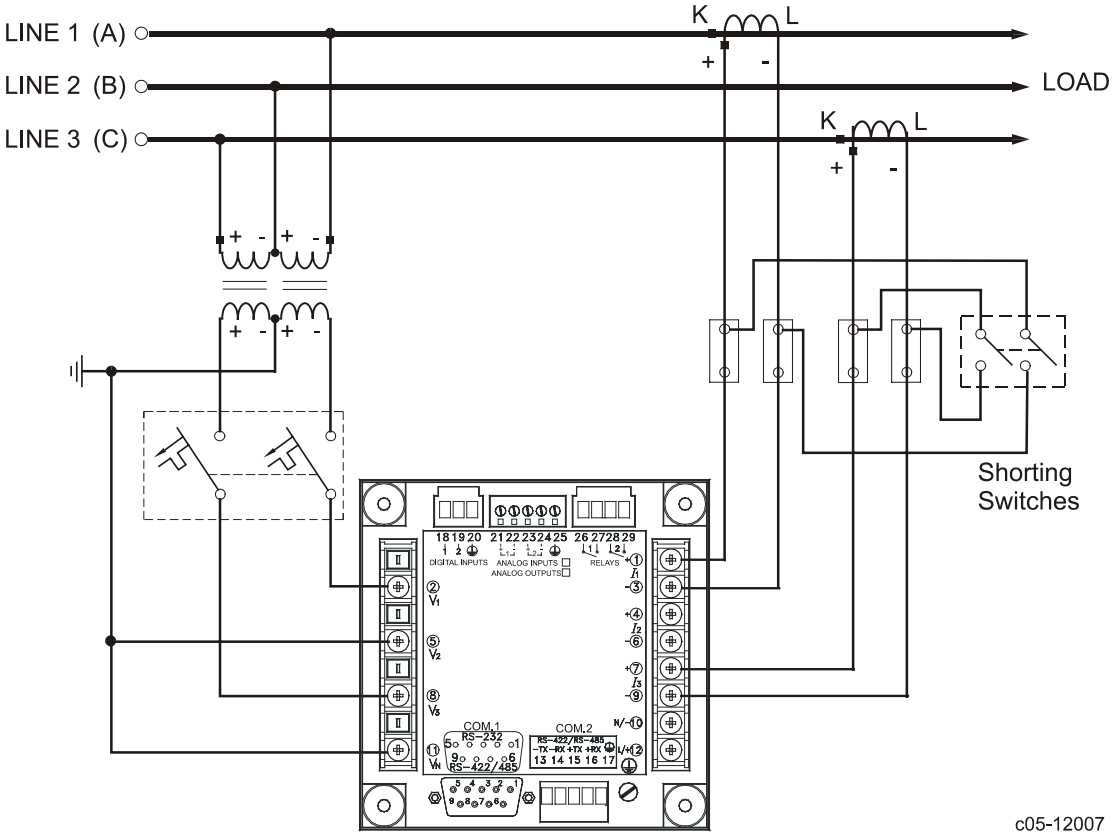


Figure 2-20 3-Wire 2-Element Open Delta Connection Using 2 PTs, 2 CTs.

Wiring Mode = 3OP2

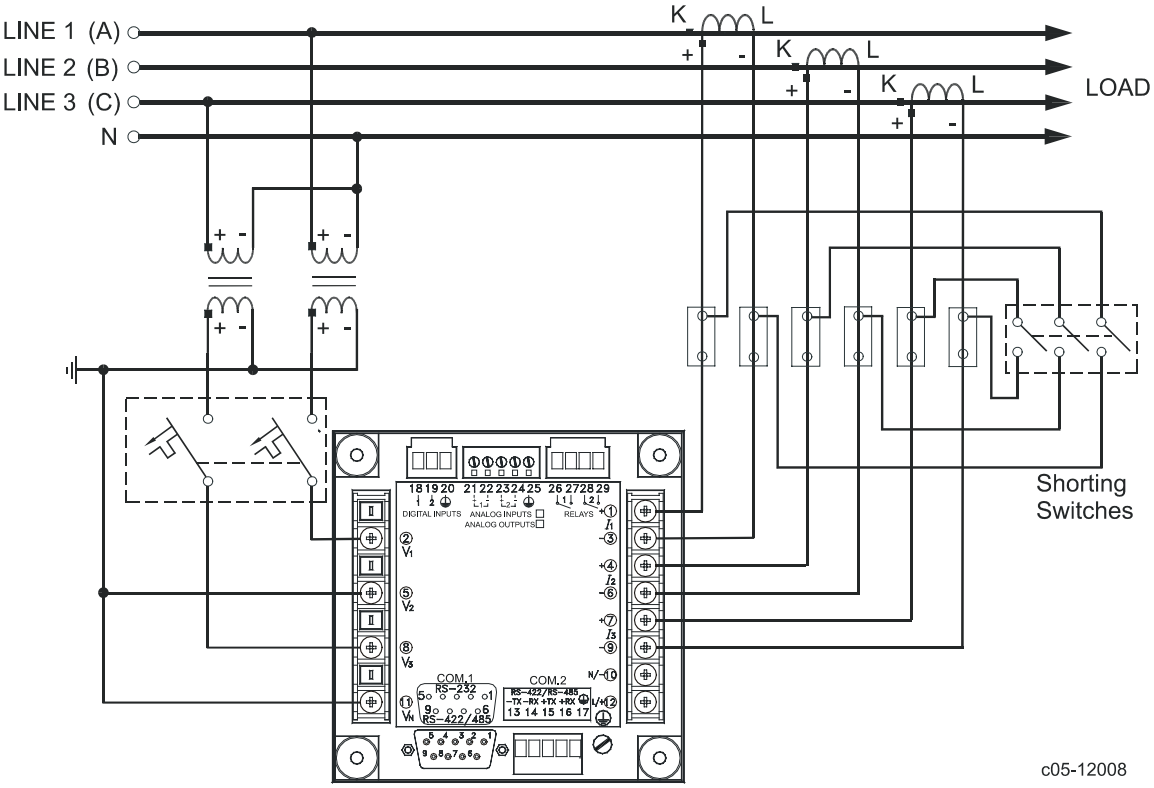


Figure 2-21 4-Wire Wye 2½-Element Connection Using 2 PTs, 3 CTs.

Wiring Mode = 3LL3 or 3Ln3

This configuration provides accurate power measurements only if the voltages are balanced.

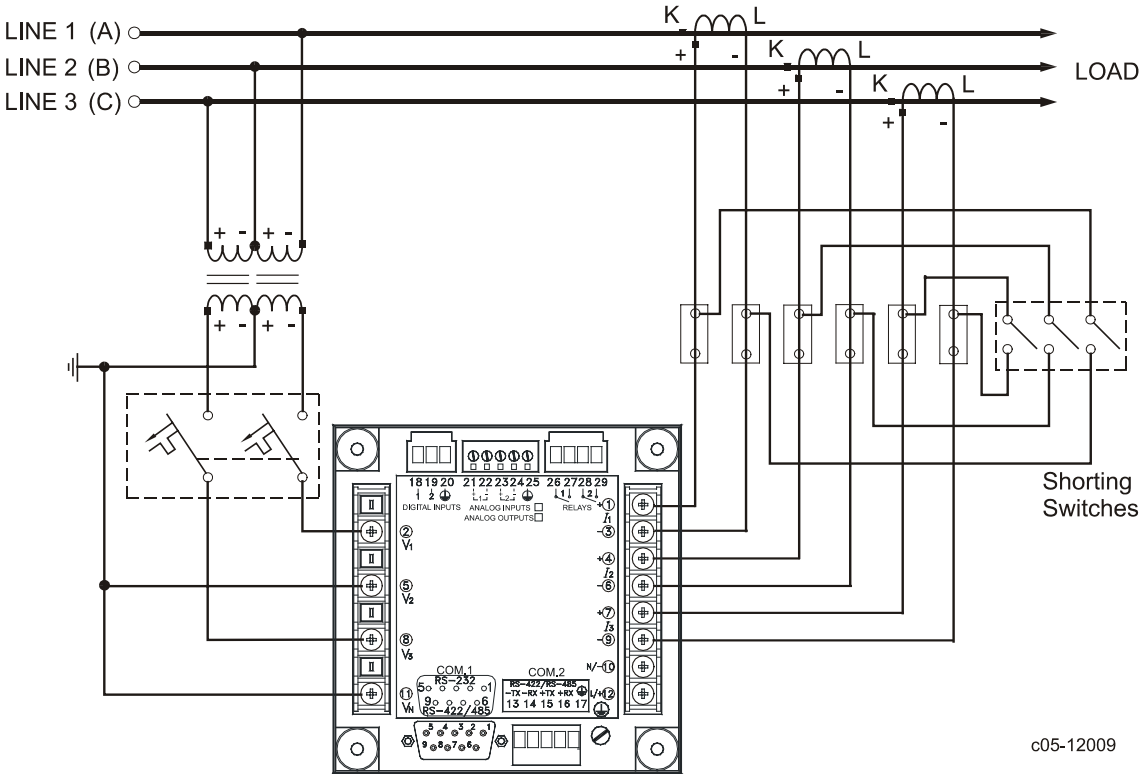


Figure 2-22 3-Wire Open 2½-Element Delta Connection Using 2 PTs, 3 CTs.

Wiring Mode = 3OP3

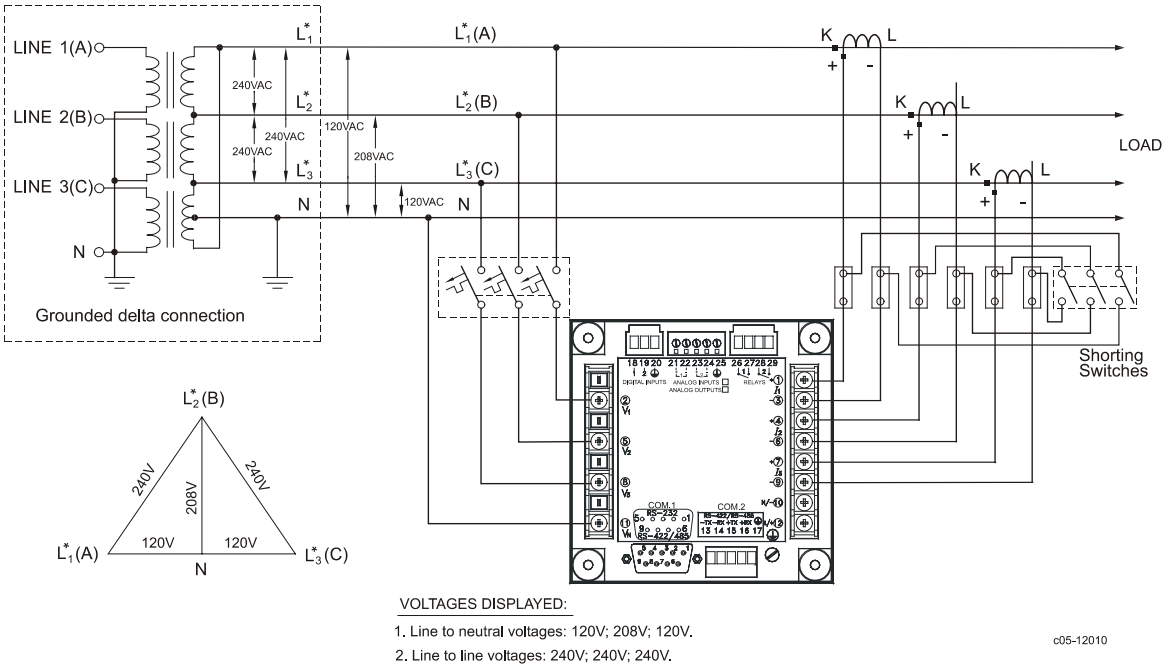


Figure 2-23 4-Wire 3-Element Delta Direct Connection Using 3 CTs.

Wiring Mode = 4LL3 or 4Ln3

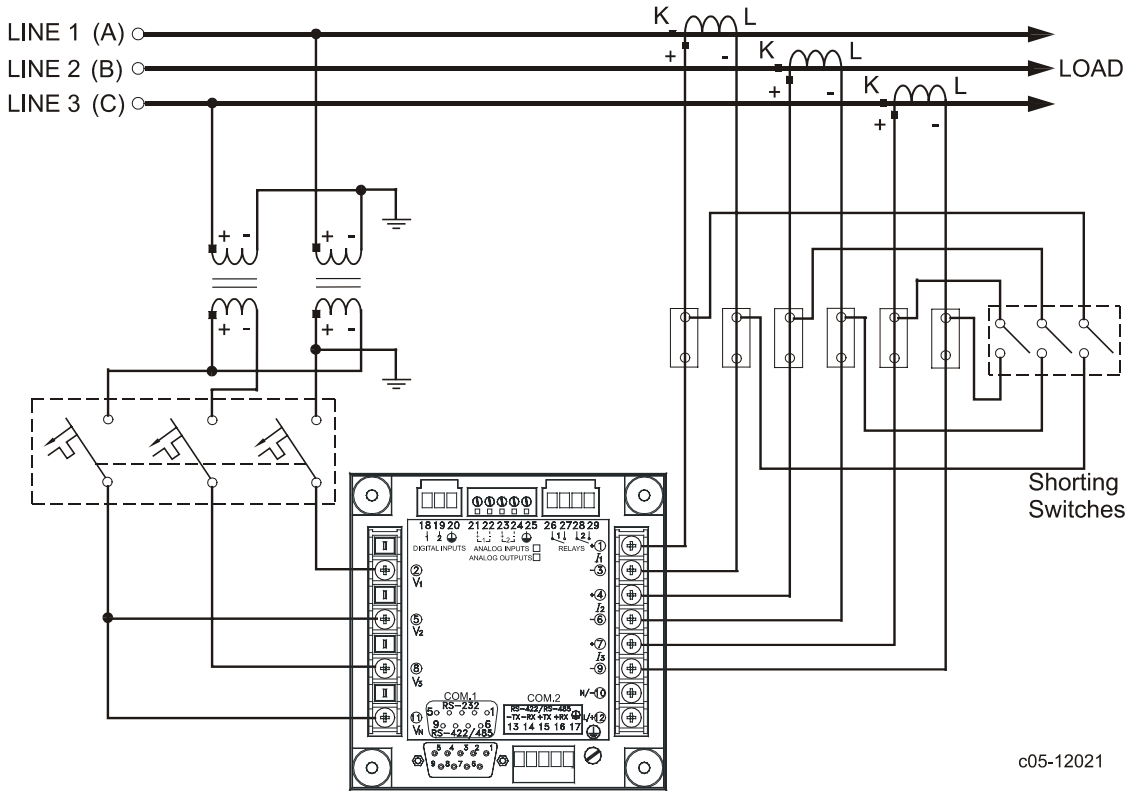


Figure 2-24 3-Wire 2½-Element Broken Delta Connection Using 2 PTs, 3 CTs.

Wiring Mode = 3bLn3 or 3bLL3

I/O Connections

For I/O ratings, see “Technical Specifications” in Appendix A.

Relay Outputs

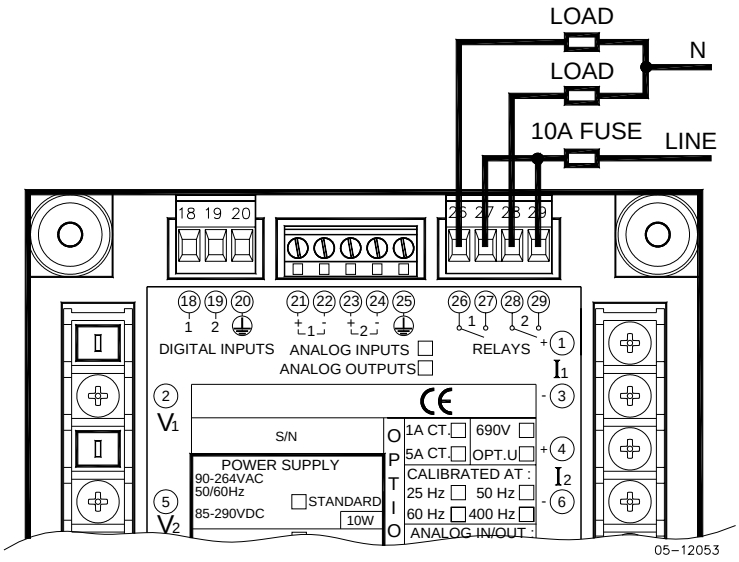


Figure 2-25 Relay Output Connection

Digital Inputs

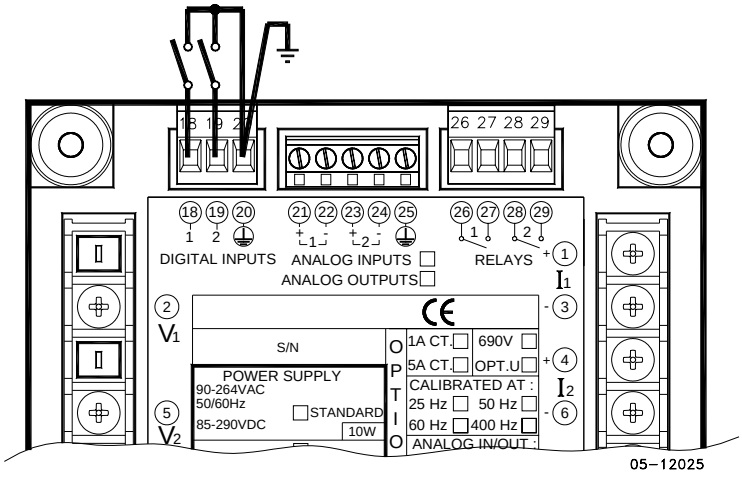


Figure 2-26 Digital Input Connection

Analog Outputs

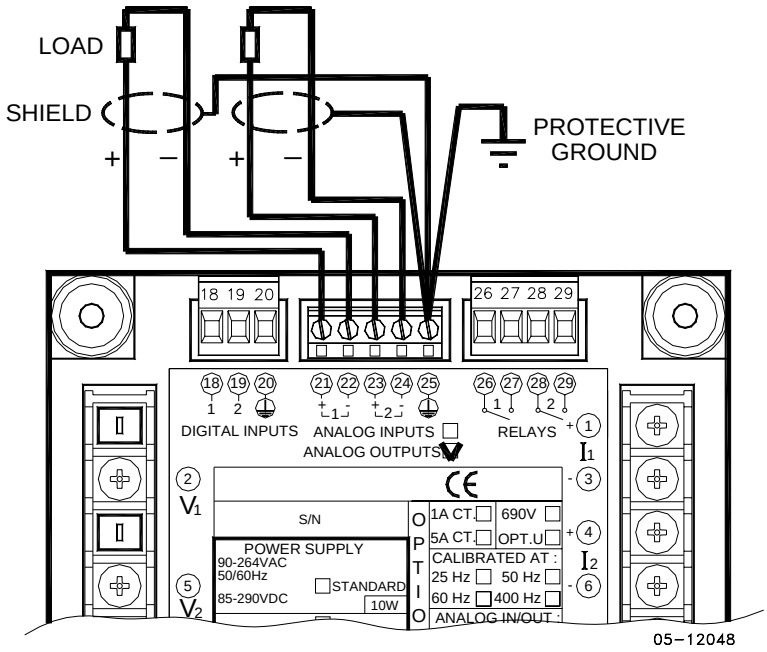


Figure 2-27 Analog Output Connection

Maximum current loop load:

510 Ohm for 0-20 mA and 4-20 mA options
5 kOhm for 0-1 mA and ±1 mA options

Analog Inputs

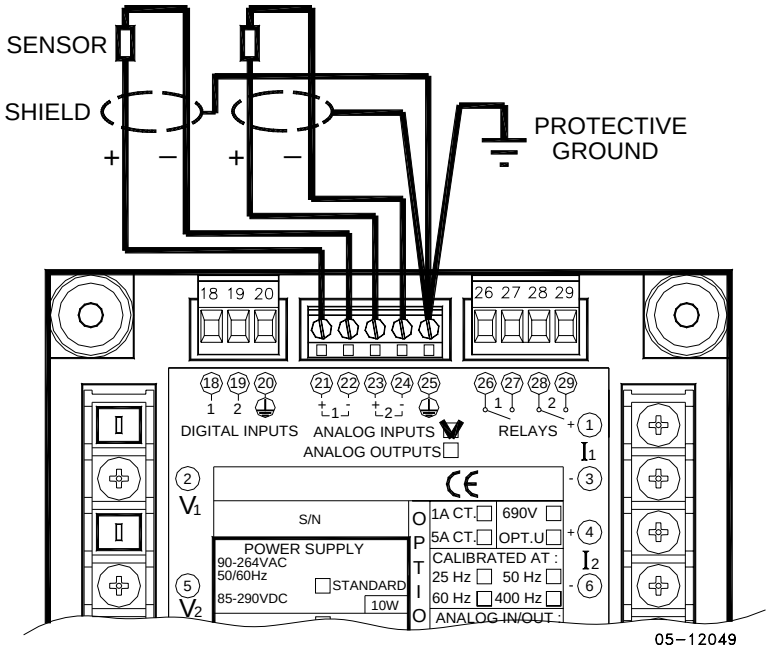


Figure 2-28 Analog Input Connection

Communications Connections

Several communication options are available for the PM175:

COM1 (check the label on the back of your meter):

- RS-232/RS-422/RS-485
- 56K Dial-up modem
- Ethernet 10/100BaseT

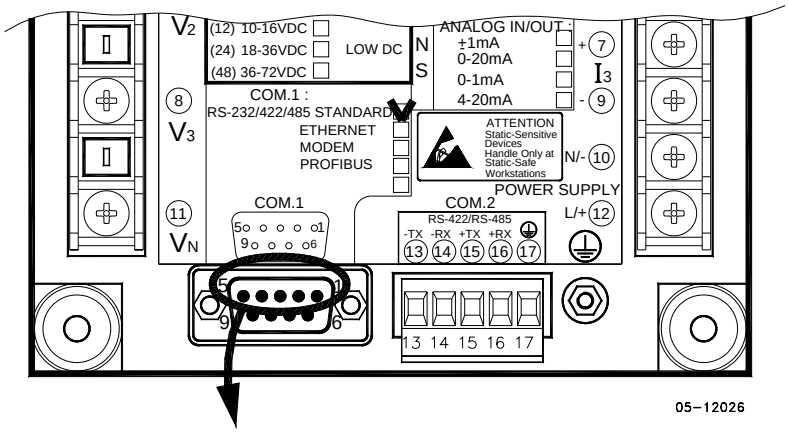
COM2:

- RS-422/RS-485

The RS-232/RS-422/RS-485 port is a standard port for COM1. Other options are ordered separately. Connections to the Ethernet RJ45 connector and to the telephone RJ11 connector are made through a cable adaptor provided with your meter (if ordered).

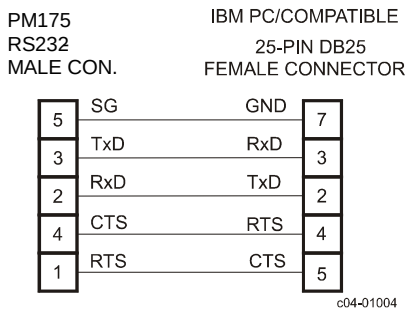
A full description of the communication protocols is found in the PM175 protocol guide provided with your meter.

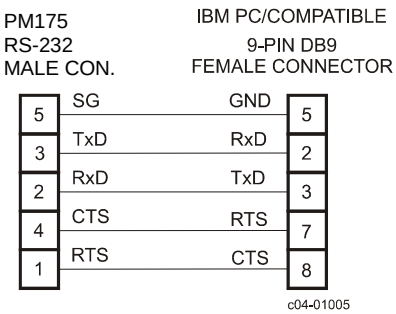
COM1 RS-232 Connection



Connector 9-pin D-type female:

Pin	Signal
1	RS-232 RTS
2	RS-232 RxD
3	RS-232 TxD
4	RS-232 CTS
5	RS-232 Signal ground





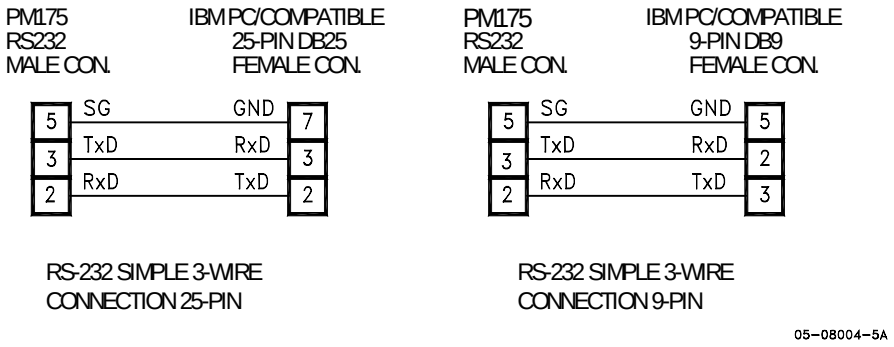
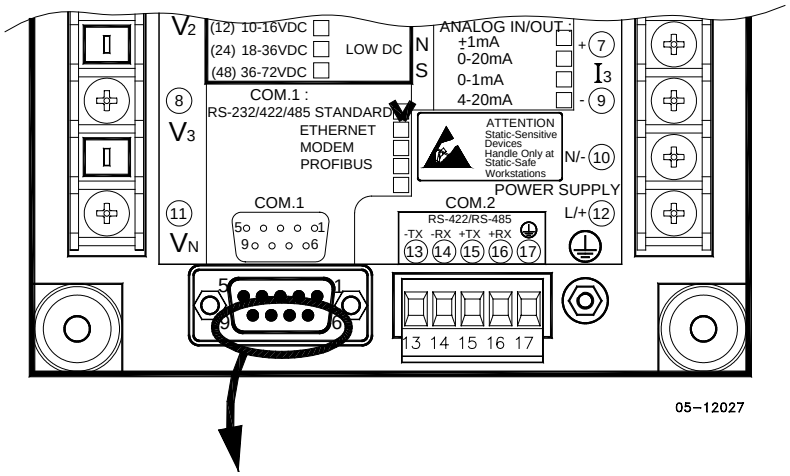


Figure 2-29 COM1: RS-232 Cable Drawings

COM1 RS-422/485 Connection



Connector 9-pin D-type female:

Pin	Signal
6	RS-422/485 +RxD
7	RS-422/485 +TxD
8	RS-422/485 –TxD
9	RS-422/485 –RxD

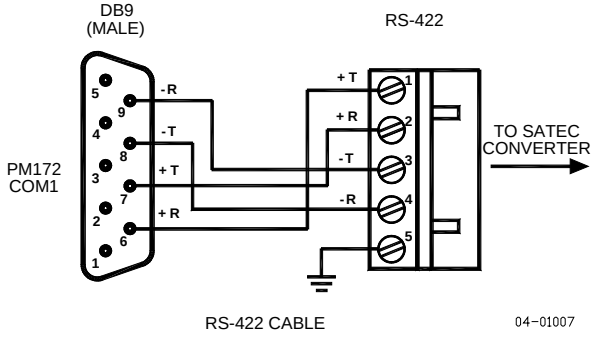


Figure 2-30 COM1: Connection to the RS-422/485-RS-232 Converter

COM1 Dial Up Modem Connection

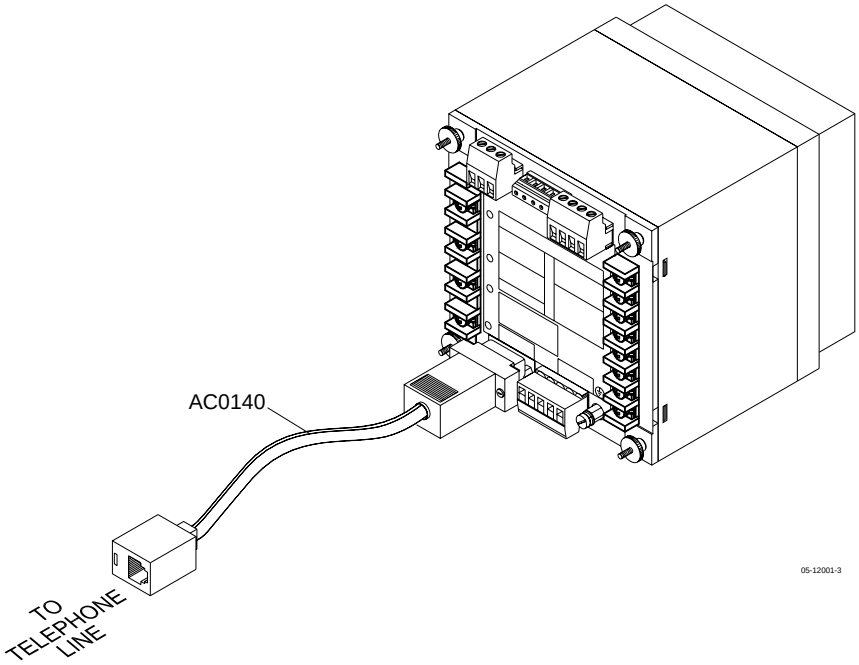


Figure 2-31 COM1: Telephone Line Connection

COM1 Ethernet Connection

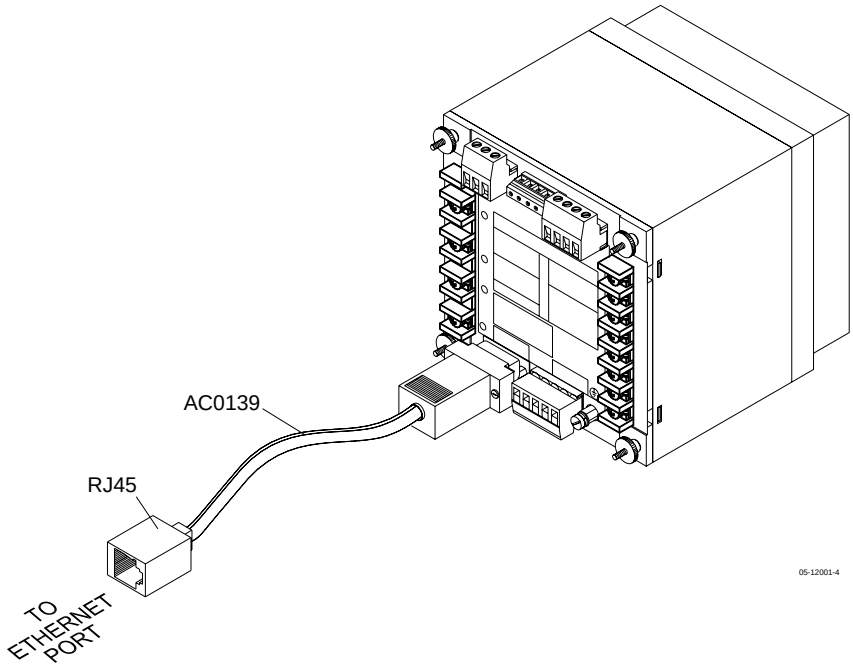
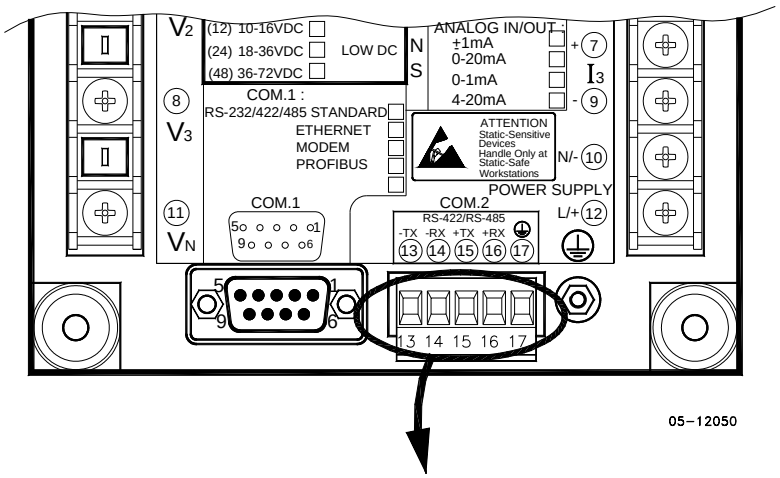


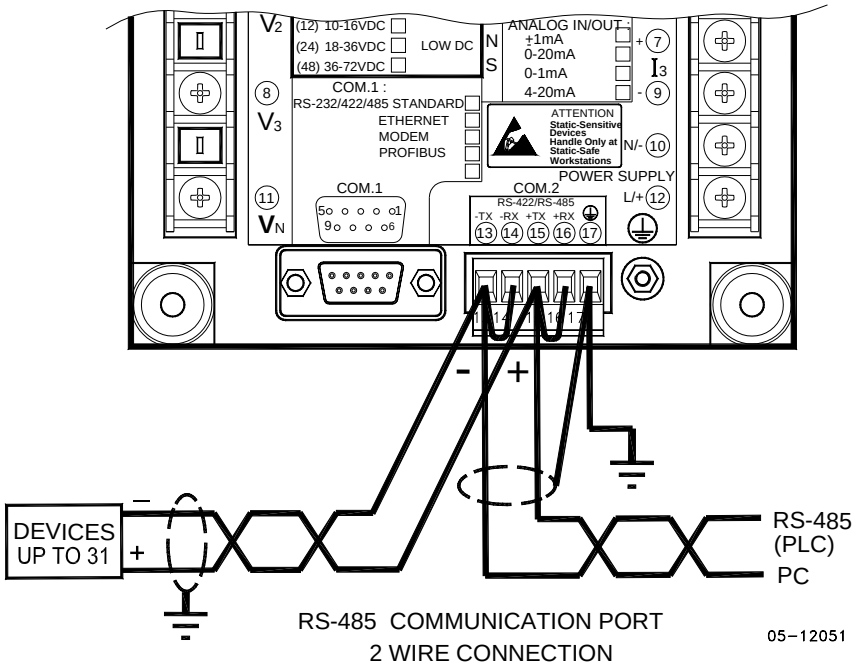
Figure 2-32 COM1: Ethernet Connection

COM2 RS-422/485 Connection



Connector removable, captured-wire, 5 terminals:

Terminal	Signal
13	-TxD
14	-RxD
15	+TxD
16	+RxD
17	Ground



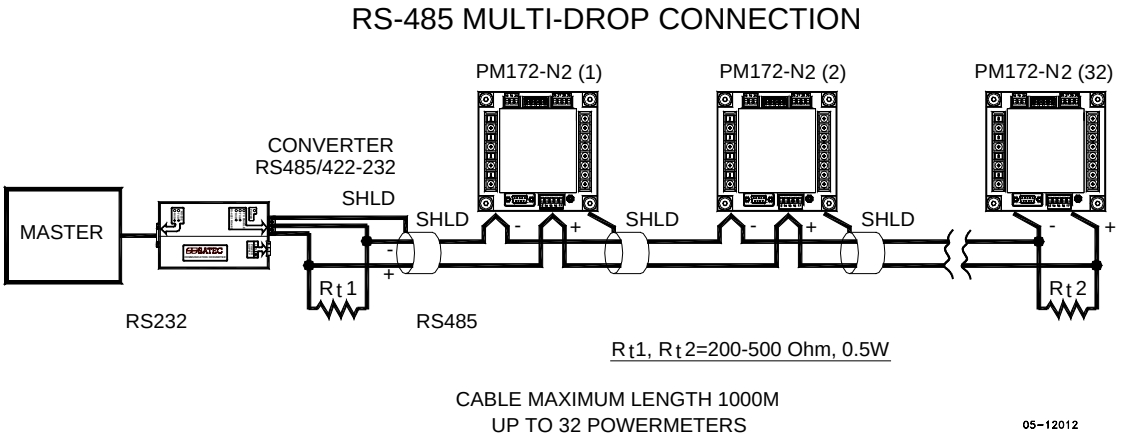


Figure 2-33 COM2: RS-485 2 Wire Connection

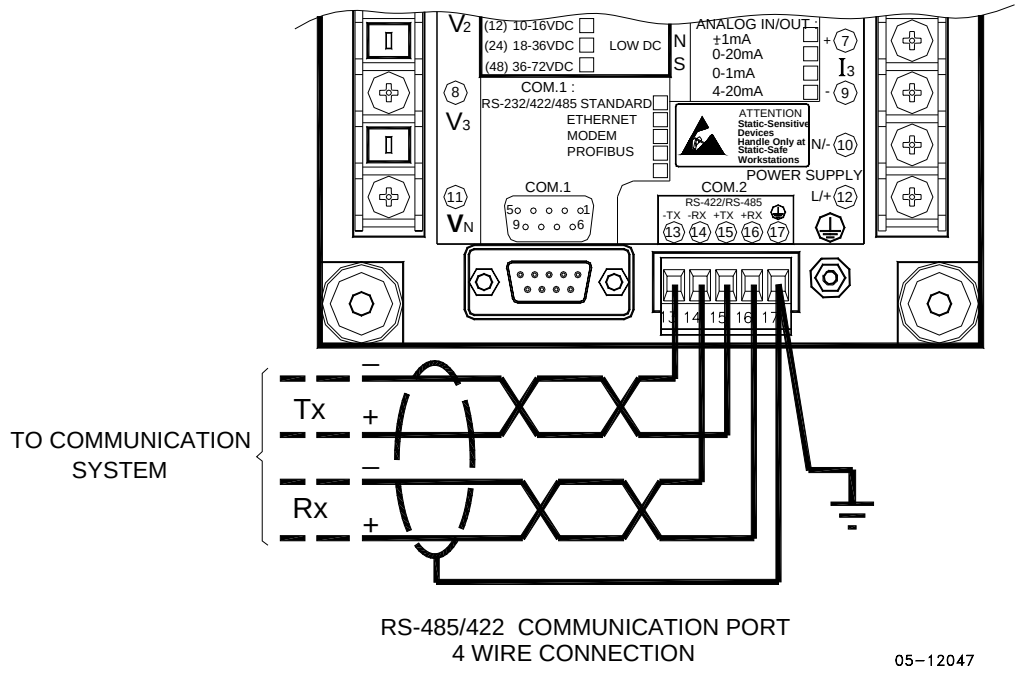
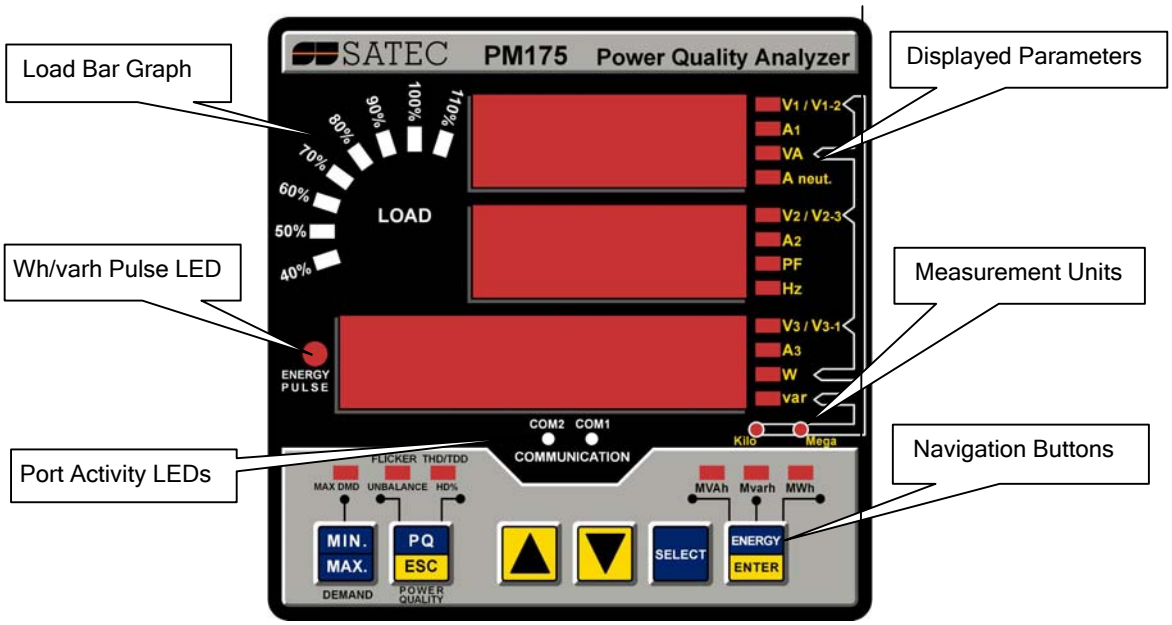


Figure 2-34 COM2: RS-422/485 4 Wire Connection

Chapter 3 Display Operations



Indicators and Controls

Numeric LED Display

The meter has a simple user interface that allows you to view numerous measurement parameters by scrolling through different display pages. The numeric LED display shows up to three parameters at a time. Small rectangular or triangular LEDs at right and below the display indicate the displayed parameters and their measurement units.

The display layout may change depending on the meter type and mode of operation. There are three modes of display operation: data display, status display, and programming mode display.

Load Bar Graph

The load bar graph displays the amount, in percent (40% to 110%), of the present current load with respect to user-defined nominal load current. The reference nominal current can be set up in amps through the Display Setup menu. If it is set to 0 (default), the current load is referenced to the specified CT primary current.

Energy Pulse LED

The PM175 has a red “Energy Pulse” LED. It flashes at a constant rate when a load is applied to the meter. There are two modes of LED operation: normal and test. In normal mode, the LED pulses indicate imported Wh at a rate of 1,000 pulses per kWh. In test mode, the LED pulses indicate either imported Wh, or imported (inductive) varh at a rate of 10,000 pulses per kWh/kvarh. The energy test mode can be enabled through the Display Setup menu. When in test mode, the energy and demand accumulators do not account for consumed energy.

Port Activity LEDs

The meter has two yellow LEDs “COM1” and “COM2”, which indicate activity on the two communication ports. The port’s LED flashes when the port is receiving or transmitting data. With the Ethernet option, the “COM1” LED flashes constantly regardless of the port activity.

When the display module is connected remotely through a 3-wire RS-485 interface, the “COM1” LED indicates the display port activity, while the “COM2” LED is not operational.

Navigation Buttons

The PM175 is provided with six push buttons that are normally used to navigate between different measurement displays. In programming mode, the buttons access the device setup menus and the default factory-set device settings can be changed.

Data Display

In data mode, the display is normally updated once per second; you can adjust the display update rate via the Display Setup menu.

Display Features

Measurement Units

Currents are always displayed in amperes with two decimal places.

Measurement units for voltage and power depend on the connection scheme of the meter:

- When direct wiring is used, voltages are displayed in volts with one decimal place, and power in kilowatts with three decimal places.
- When wiring via PT is used, for the PT ratio up to and including 4.0, voltages are displayed in volts, and power in whole kilowatts
- For the PT ratio above 4.0, voltages are displayed in kilovolts, and power in megawatts with three decimal places.

The small round “Kilo” and “Mega” LEDs light up showing the appropriate measurement units for a displayed page.

Primary and Secondary Volts

Volts can be displayed in primary (default) or secondary units. The volts display mode can be changed through the Display Setup menu.

Phase Power Readings

In configurations with the neutral wire, in addition to total three-phase powers, the meter can show per-phase power readings. By default, they are disabled. See Display Setup on how to enable per-phase power readings in your meter.

Fundamental Component

The meter can display total power factor and active power for the fundamental component if it is enabled through the Display Setup menu. Whenever phase power readings are allowed, the PM175 also displays per-phase power factor and active power for the fundamental component.

Auto Return

If no buttons are pressed for 30 seconds while the display Auto Return option is enabled, the display automatically returns to the main screen from any other measurement display or programming mode.

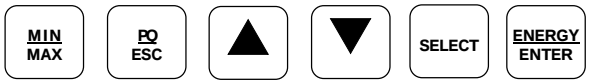
The Auto Return option can be enabled through the Display Setup menu

Auto Scroll

If no buttons are pressed for 30 seconds while in the common measurements display, and the Auto Scroll option is enabled in the meter, the display automatically scrolls through all available pages. The scroll interval can be adjusted through the Display Setup menu.

To stop auto scrolling, press briefly the SCROLL button.

Navigation Buttons



In Data Display mode, the navigation buttons function as follows.

The **MIN/MAX** button switches to the Min/Max - Maximum Demands display pages. When briefly pressed again, it switches back to the common measurements display.

The **PQ** button switches between different power quality/harmonic displays: Total Harmonics, Individual Voltage and Current Harmonics, and Power Quality parameters – short-term (Pst) and long-term (Plt) flicker, and voltage and current negative sequence unbalance. When briefly pressed once again, it switches back to the common measurements display

The **UP** and **DOWN** arrow buttons, labeled by arrowheads, scroll forwards and backwards through the display pages. Pressed briefly, they move one page forward or backward. If you hold down the button the display pages are scrolled at rate of a twice per second.

Pressing both the UP and DOWN arrow buttons together returns to the first page within the current display.

The **SELECT** button operates once it's released. The button has two functions:

- When pressed briefly, it switches to programming mode.
- When pressed together with the ENTER button for more than 5 seconds, it resets Min/Max records, maximum demands, or energies depending on the currently displayed page. If the meter is password protected, and a simple reset of data from the display is not allowed, the action has no effect.

The **ENERGY** button switches to the Energy display. If TOU registers are configured in the meter, you can repeatedly press this button to scroll through all available TOU registers. When briefly pressed once again, it switches back to the common measurements display

Simple Reset of Accumulated Data

When the meter is not password protected, or the simple reset of data is allowed from the display regardless of the security setting (see Display Setup), the meter allows the simple "two-button' reset of the Min/Max registers, maximum demands, energies, and counters from the data display mode without entering the reset menu:

1. Select a display page where the data you want to reset is displayed:

   Min/Max log - select a Min/Max page from the Min/Max Display.

   Ampere and volt maximum demands - select the ampere or volt maximum demand page from the Min/Max Display.

   Power maximum demands - select the power maximum demand page from the Min/Max Display.

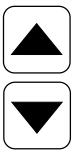
   Total and phase energies - select a total energy, or phase energy page from the Energy Display.

   Counters – select a counter page from the Status Display

2. While holding the SELECT button, press and hold the ENTER button for about 5 seconds. The displayed data is reset to zero.

Common Measurements Display

Scroll through pages with the UP and DOWN arrow buttons.



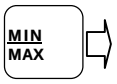
Common Measurements (Main Display)			
1		V12 V23 V31	Line-to-line volts
	L		
2		V1 V2 V3	Line-to-neutral volts (in configurations with a neutral wire: 4LN3, 3LN3, 3BLN3, 4LL3, 3LL3, and 3BLL3)
	P		
3		I1 I2 I3	Amps
4		kVA/MVA PF kW/MW	Total VA Total PF Total W
5		In Hz kvar/Mvar	Neutral current Frequency Total var
6		**Ph.L1** PF kW/MW	Phase L1 powers (if enabled)
7		kVA/MVA **Ph.L1** kvar/Mvar	Phase L1 powers (if enabled)
8		**Ph.L2** PF kW/MW	Phase L2 powers (if enabled)
9		kVA/MVA **Ph.L2** kvar/Mvar	Phase L2 powers (if enabled)
10		**Ph.L3** PF kW/MW	Phase L3 powers (if enabled)
11		kVA/MVA **Ph.L3** kvar/Mvar	Phase L3 powers (if enabled)
12		**H01** PF kW/MW	Fundamental total powers (if enabled)
13		**H1.L1** PF kW/MW	Fundamental phase L1 powers (if enabled)
14		**H1.L2** PF kW/MW	Fundamental phase L2 powers (if enabled)
15		**H1.L3** PF kW/MW	Fundamental phase L3 powers (if enabled)

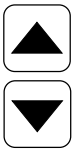
Common Measurements (Main Display)		
16	**An.In** AI1 AI2	Analog inputs (optional)

Min/Max and Max. Demands Display

Press the MIN/MAX button. The MIN/MAX LED, or MAX DEMAND LED in the PM175, is illuminated when in the MIN/MAX display. Use the UP and DOWN arrow buttons to scroll through the Min/Max and Max. Demand pages.

Note that volts readings are line-to-neutral in 4LN3, 3LN3 and 3BLN3 wiring modes, and line-to-line in other modes.



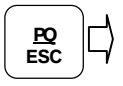


Min/Max and Maximum Demands			
1		V1/V12 V2/V23	Minimum volts
	Lo	V3/V31	
2		I1 I2	Minimum amps
	Lo	I3	
3		kVA/MVA PF	Minimum total VA Minimum total PF (absolute)
	Lo	kW/MW	Minimum total W
4		In Hz	Minimum neutral current Minimum frequency
	Lo	kvar/Mvar	Minimum total var
5		V1/V12 V2/V23	Maximum volts
	Hi	V3/V31	
6		I1 I2	Maximum amps
	Hi	I3	
7		kVA/MVA PF	Maximum total VA Maximum total PF (absolute)
	Hi	kW/MW	Maximum total W
8		In Hz	Maximum neutral current Maximum frequency
	Hi	kvar/Mvar	Maximum total var
9		V1/V12 V2/V23	Maximum volt demands
	Hd	V3/V31	
10		I1 I2	Maximum ampere demands
	Hd	I3	
11		kVA/MVA PF	Maximum VA demand PF at maximum VA demand
	Hd	kW/MW	Maximum W demand

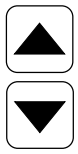
Power Quality/Harmonics Display

Press the PQ/ESC button. The THD/TDD LED is illuminated. Press the button again to move to the individual harmonics, or to the flicker and unbalance displays. Use the UP and DOWN arrow buttons to scroll through harmonics and power quality measurements.

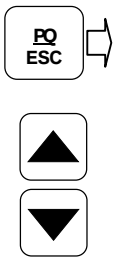
Note that voltage harmonics readings are line-to-neutral in the 4LN3, 3LN3 and 3BLN3 wiring modes, and line-to-line in all other modes.



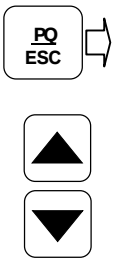
Total Harmonics			
1		V1/V12 THD V2/V23 THD	Voltage THD
	thd.	V3/V31 THD	



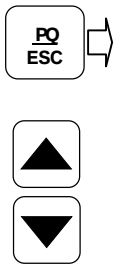
Total Harmonics			
2		I1 THD	Current THD
		I2 THD	
	thd.	I3 THD	
3		I1 TDD	Current TDD
		I2 TDD	
	tdd.	I3 TDD	
4		I1 K-Factor	Current K-Factor
		I2 K-Factor	
	HF	I3 K-Factor	



Individual Voltage Harmonics			
1		V1/V12 HD%	Order 2 harmonic distortion
		V2/V23 HD%	
	02H	V3/V31 HD%	
2		V1/V12 HD%	Order 3 harmonic distortion
		V2/V23 HD%	
	03H	V3/V31 HD%	
39		V1/V12 HD%	Order 40 harmonic distortion
		V2/V23 HD%	
	40H	V3/V31 HD%	



Individual Current Harmonics			
1		I1 HD%	Order 2 harmonic distortion
		I2 HD%	
	02H	I3 HD%	
2		I1 HD%	Order 3 harmonic distortion
		I2 HD%	
	03H	I3 HD%	
39		I1 HD%	Order 40 harmonic distortion
		I2 HD%	
	40H	I3 HD%	

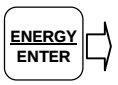


Flicker / Unbalance			
1		V1 Pst	Short term flicker
		V2 Pst	
	Pst	V3 Pst	
2		V1 Plt	Long term flicker
		V2 Plt	
	Plt	V3 Plt	
3		**U.Unb**	
		V% unb	Voltage negative sequence unbalance, percent
4		**C.Unb**	
		I% unb	Current negative sequence unbalance, percent

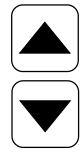
Energy Display

Press the ENERGY button. The MVAh, Mvarh, or MWh LED is illuminated. If TOU registers are configured in the meter, press the button again to scroll through all active TOU registers. Use the UP and DOWN arrow buttons to scroll through energy pages.

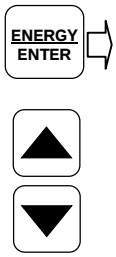
Along with total energies, per phase energy accumulators are displayed if phase energy calculation is enabled in the Device Options menu.



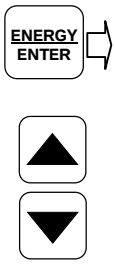
Total and Phase Energies			
1		**Ac.En.**	Total Wh import
		IP.	
		MWh	



Total and Phase Energies		
2	**rE.En.** **IP.** Mvarh	Total varh import
3	**AP.En.** MVAh	Total VAh
4	**Ac.En.** **EP.** MWh	Total Wh export
5	**rE.En.** **EP.** Mvarh	Total varh export
6	**Ac.En.** **IP.L1.** MWh	Phase L1 Wh import
7	**rE.En.** **IP.L1.** Mvarh	Phase L1 varh import
8	**AP.En.** **L1.** MVAh	Phase L1 VAh
9	**Ac.En.** **IP.L2.** MWh	Phase L2 Wh import
10	**rE.En.** **IP.L2.** Mvarh	Phase L2 varh import
11	**AP.En.** **L2.** MVAh	Phase L2 VAh
12	**Ac.En.** **IP.L3.** MWh	Phase L3 Wh import
13	**rE.En.** **IP.L3.** Mvarh	Phase L3 varh import
14	**AP.En.** **L3.** MVAh	Phase L3 VAh

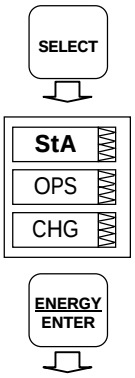


TOU Energy Register 1		
1	**rEG.1** **trF.1** MWh	Tariff 1 reading
2	**rEG.1** **trF.2** MWh	Tariff 1 reading
8	**rEG.1** **trF.8** MWh	Tariff 8 reading



TOU Energy Register 8		
1	**rEG.8** **trF.1** MWh	Tariff 1 reading
2	**rEG.8** **trF.2** MWh	Tariff 1 reading
8	**rEG.8** **trF.8** MWh	Tariff 8 reading

Status Display



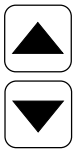
The meter has separate status information pages accessible through the primary device menu. The Status Display shows rarely used information that is especially helpful when connecting the meter inputs and outputs to external equipment. For information on navigating in the menus, see Using the Menus.

To enter the Status Display:

1. From the Data Display, press the SELECT button to enter the primary device menu. The "StA" window is highlighted.
2. Press ENTER to enter the Status Display. Use the UP and DOWN arrow buttons to scroll through the status pages.

To exit the Status Display:

1. Press ESC to return to the primary device menu.
2. Press ESC to return to the Data display.



Status Display		
1	**PhS** **rot** POS/nEG/Err	Phase rotation order
2	V1 angle V2 angle **AG.** V3 angle	Voltage angles (±180°, referenced to V1)
3	I1 angle I2 angle **AG.** I3 angle	Current angles (±180°, referenced to V1)
4	**rEL** **1.2.** 00	Relay status
5	**St.In** **1.2.** 00	Status inputs
6	**Cnt.1** Counter #1	
7	**Cnt.2** Counter #2	
8	**Cnt.3** Counter #3	
9	**Cnt.4** Counter #4	
10	**batt** nor/Lo	Backup battery status (Normal/Low)

Using the Menus

Navigation Buttons

The PM175 has a menu-driven setup. To enter the menus, press and release the SELECT button.

The **SELECT** button selects (highlights) an active window in which you can select or change a desired menu item. The button operates once it's briefly pressed and released.

The **UP** and **DOWN** arrow buttons scroll through menu items in the highlighted window forwards and backwards, and allow changing a highlighted item when entering numbers.

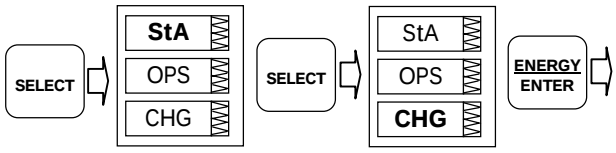
The **ENTER** button confirms the selection of a menu item or a number in the highlighted window, thus allowing to enter a submenu or to store a changed item.

The **ESC** button is "Escape" leaving the highlighted item unchanged or returning to the upper level menu.

Selecting Menus

To access the meter menus, press and release the SELECT button. The primary meter menu is open as shown below. The menu has three entries:

- StA - Status Display entry (see "Status Display" above)
- OPS – Main setup menu entry allowing to review setup options
- CHG – Main setup menu entry allowing to change setups



To enter the Status Display:

1. If the StA window is not highlighted, use the SELECT button to activate it.
2. Press the ENTER button to enter the Status Display

To review the meter setup options:

1. Press the SELECT button to activate the OPS window.
2. Press the ENTER button to enter the main menu.

To change the meter setup, or to clear the accumulated values:

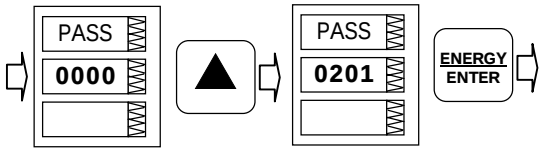
1. Press the SELECT button to activate the CHG window.
2. Press the ENTER button to enter the main menu.

Entering the Password

The Setup Change menu can be secured by a four-digit user password. The meter is primarily shipped with the password preset to 0 and password

protection disabled. You can change the password and enable password protection through the Access Control menu (see Meter Security).

If authorization is not required, just press the ENTER button to move to the Main menu; otherwise you should enter a correct password to be authorized to access the meter setup.



To enter the password:

1. Adjust the first digit with the UP and DOWN arrow buttons.
2. Press the SELECT button to advance to the next digit.
3. Adjust the remaining password digits in the same manner.
4. Press ENTER to confirm the password.

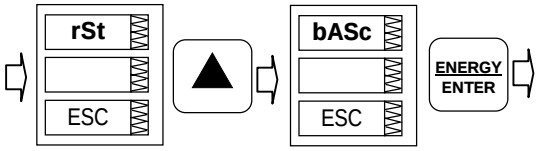
If the password entered is correct, you move to the Main menu, otherwise you return to the previous menu.

Selecting the OPS or CHG entry moves you to the Main menu that is represented by two entries: the upper window displays a secondary menu list, while the bottom item is an assisting exit window.

Selecting a Menu Entry

To select a menu entry from the menu list:

1. Highlight the upper item by pressing the SELECT button.



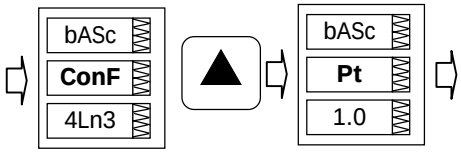
2. Scroll through the menu list by pressing briefly the UP and DOWN arrow buttons until the desired menu entry appears.
3. Press the ENTER button.

Viewing and Changing Setup Items

A second level menu normally consists of three items: the upper static window indicates the menu name, while the middle window represents a list of setup parameters you can scroll through, and the lower item shows the present parameter value.

To select a parameter you want to view or change:

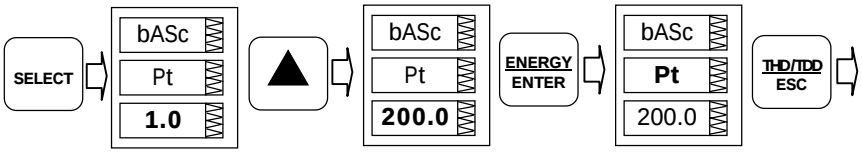
1. Highlight the middle window by pressing the SELECT button.



2. Scroll through the parameter list with the UP and DOWN buttons until the desired parameter name appears.

To change the selected parameter:

1. Press the SELECT button to highlight the lower item.



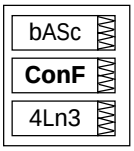
2. If a number represents the parameter, adjust it to the desired value with the UP and DOWN arrow buttons. When briefly pressed, the button increments or decrements the number by one. When the button is pressed continuously, the number is changed approximately twice per second.
3. If a name represents the parameter, select the desired option with the UP and DOWN arrow buttons.
4. To store your new selection, press the ENTER button.
5. To leave the parameter unchanged, press the ESC button.

You will return to the parameter list to select another parameter or return to the main menu.

To exit the menu, press ESC.

Menu Operations

Basic Device Settings



This menu allows you to configure the basic meter settings that define the general operating characteristics of the device. To enter the menu, select the "baSc" entry from the main menu, and then press the ENTER button.

To select a setup option:

1. Press the SELECT button to activate the middle window.
2. Use the UP and DOWN arrow buttons to scroll to the desired option.

To change the option:

1. Press the SELECT button to activate the lower window.
2. Use the UP and DOWN arrow buttons to select the desired option.
3. Press ENTER to confirm your changes and to store your new setting, or press ESC to discard changes.

To exit the menu, press ESC.

The following table lists available options.

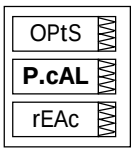
Label	Parameter	Options	Default	Description
ConF	Wiring connection (configuration) mode	See "Basic Meter Setup" in Chapter 4	4Ln3	The wiring connection of the device
Pt	PT ratio	1.0-6500.0	1.0	The phase potential transformer's primary to secondary ratio

Label	Parameter	Options	Default	Description
Pt.F	PT Ratio multiplier	×1, ×10	×1	PT Ratio multiplication factor. Used in extra high voltage networks to accommodate the PT ratio for 500 kV and higher networks.
U.SEC	Nominal secondary voltage	10-690 V	120 V	The nominal secondary line-to-neutral (in 4LN3, 3LN3 and 3BLN3 wiring modes) or line-to-line (in 4LL3, 3LL3, 3BLL3, 3OP2, 3OP3 and 3DIR modes) voltage. Used as a reference voltage for the EN50160 evaluation.
Ct	CT primary current	1-10000 A	5 A	The primary rating of the phase current transformer
d.P	Power block demand period	1, 2, 5, 10, 15, 20, 30, 60 min, E=external sync	30 min	The length of the demand period for power demand calculations. If the external synchronization is selected, a pulse front on the digital input DI1 denotes the start of the demand interval.
nd.P	The number of blocks in the sliding window	1-15	1	The number of blocks to be averaged for sliding window demands
Ad.P	Ampere, volt and THD demand period	0-1800 sec	900 sec	The length of the demand period for ampere, volt and THD demand calculations
Freq	Nominal frequency	50,60 Hz	60 Hz	The nominal line frequency
LoAd	Maximum demand load current	0-10000 A	0	The maximum demand load current (0 = CT primary)

△ Always specify the wiring mode and transformer ratings prior to setting up setpoints and analog outputs.

△ The maximum value for the product of the phase CT primary current and PT ratio is 57,500,000. If the product is greater, power readings are zeroed.

Device Options



This menu allows you to change the user-configurable device options or put the meter into energy test mode. To enter the menu, select the "OPtS" entry from the Main menu, and then press the ENTER button.

To select a setup option:

1. Press the SELECT button to activate the middle window.
2. Use the UP and DOWN arrow buttons to scroll to the desired option.

To change the option:

1. Press the SELECT button to activate the lower window.
2. Use the UP and DOWN arrow buttons to select the desired option.
3. Press ENTER to confirm your changes and to store your new setting, or press ESC to discard changes.

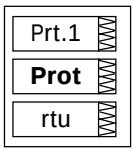
To exit the menu, press ESC.

The following table lists available options.

Label	Parameter	Options	Default	Description
P.cAL	Power calculation mode	rEAc (reactive power), nAct (non-active power)	Reactive	The method used for calculating reactive and apparent powers
roLL	Energy roll value[E]	10.E4=10,000 10.E5=100,000 10.E6=1,000,000 10.E7=10,000,000 10.E8=100,000,000 10.E9=1,000,000,000	10.E9	The value at which energy counters roll over to zero
Ph.En	Phase energy option[E]	diS = disabled En = enabled	Disabled	Enables phase energy calculations
bAtt	Backup battery mode	OFF = switched OFF On = switched ON	OFF	Allows to conserve a battery while the meter is out of operation
tESt	Energy test mode	OFF = disabled Ac.Ei = Wh pulses rE.Ei = varh pulses	Disabled	Setting this option puts the meter into the energy test mode

Communication Ports

These two menus allow you to configure parameters for communication ports COM1 and COM2. To enter the menu, select "Prt.1" for COM1 or "Prt.2" for COM2 from the main menu, and then press the ENTER button.



To select a setup option:

1. Press the SELECT button to activate the middle window.
2. Use the UP and DOWN arrow buttons to scroll to the desired option.

To change the option:

1. Press the SELECT button to activate the lower window.
2. Use the UP and DOWN arrow buttons to select the desired option.
3. Press ENTER to confirm your changes and to store your new setting, or press ESC to discard changes.

To exit the menu, press ESC.

The following tables list available port options.

COM1 Settings

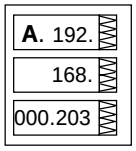
Label	Parameter	Options	Default	Description
Prot	Communications protocol	rtu = Modbus RTU ASCII =Modbus ASCII	Modbus RTU	The communications protocol supported by the port
rS	Port interface[1]	232 = RS-232 485 = RS-485 422 = RS-422 dial = Dial-up Modem Eth.= Ethernet	Depends on the order	For non-serial interfaces - not changeable; automatically detected by the meter
Addr	Device address	Modbus: 1-247	1	Device network address
bAud	Baud rate	300-115200 bps	19200 bps	The port baud rate
dAtA	Data format and parity	7E, 8N, 8E	8N	7E data format should not be used with the Modbus RTU protocol
H.Sh	Handshaking (flow control)	nonE=no flow control SOFt=software (XON/XOFF) HArd=hardware (CTS)	None	
rtS	RTS mode	nonE = not used Forc = RTS is permanently asserted CtrL = RTS is asserted during the transmission	None	

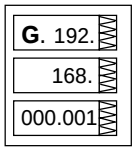
[1] The meter automatically detects a replaceable communication module and does not allow you to change the interface, baud rate or data format for the Dial-up modem, and for the Ethernet port.

COM2 Settings

Label	Parameter	Options	Default	Description
Prot	Communications protocol	rtu = Modbus RTU ASCII = Modbus ASCII	Modbus RTU	The communications protocol supported by the port
rS	Port interface	485 = RS-485 422 = RS-422	RS-485	
Addr	Device address	Modbus: 1-247	1	Device network address
bAud	Baud rate	300-115200 bps	19200 bps	The port baud rate
dAtA	Data format and parity	7E, 8N, 8E	8N	7E data format should not be used with the Modbus RTU protocol

Network Address





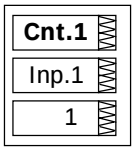
This menu allows you to configure the device IP address and the default gateway address for the Ethernet port. To enter the menu, select “nEt” from the main menu, and then press the ENTER button.

To change the IP Address and Default Gateway:

1. To change the device IP address, select the “A” entry in the upper window with the UP and DOWN arrow buttons. To change the default gateway address, select the “G” entry.
2. Press the SELECT button to activate the first address digit.
3. Use the UP and DOWN arrow buttons to adjust the digit.
4. Press the SELECT button to advance to the next digit.
5. Adjust the remaining address digits.
6. Press ENTER to confirm your new setting, or press ESC to discard changes.

To exit the menu, press ESC.

Counters Setup



The PM175 has four six-digit counters that can count pulses delivered through the device digital inputs with a programmable scale factor, or events that trigger setpoint operations. This menu allows you to link digital inputs to the counters and define a pulse multiplier for each counter. To enter the menu, select the “Cnt” entry from the main menu and press the ENTER button.

The menu uses three entries:

1. The upper window indicates a counter number.
2. The middle window selects a digital input to be linked to the counter.
3. The lower window defines a counter multiplier.

Use the UP and DOWN arrow buttons to scroll to the desired counter.

To change the counter options:

1. Press the SELECT button to activate the middle window.
2. Use the UP and DOWN arrow buttons to link a digital input to the counter or to disable the counter input.
3. Press the SELECT button to activate the lower window.
4. Use the UP and DOWN arrow buttons to enter the desired multiplier.
5. Press ENTER to confirm your changes and to store the new settings, or press ESC to discard changes.
6. You are returned to the upper window to select another counter or exit the menu.

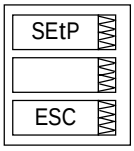
To exit the menu, press ESC.

The following table lists available counter options.

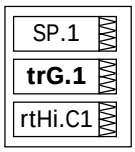
Parameter	Options	Default	Description
Pulse source	None = disabled Inp.1 = DI1 Inp.2 = DI2	None	Links a digital input to the counter
Multiplier	1-9999	1	The value added to the counter when a pulse is detected on the pulse source input, or the counter is incremented through a setpoint action

Control Setpoint Setup

The PM175 provides 16 control setpoints with programmable operate and release delays. Each setpoint evaluates a logical expression with up to four arguments using OR/AND logic. Whenever an expression is evaluated as "true", the setpoint performs up to four concurrent actions that can send a command to the output relays, increment or decrement a counter, or trigger a recorder. For more information on setpoints operation, see Using Control Setpoints in Chapter 4.

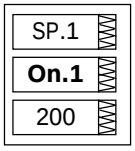


This menu configures setpoints through the front display. To enter the menu, select the "SEtP" entry from the main menu, and press the ENTER button.



The menu uses three entries:

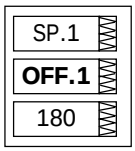
1. The upper window indicates a setpoint number.
2. The middle window selects a setup parameter to view or change.
3. The lower window displays the parameter value.



Use the UP and DOWN arrow buttons to scroll to the desired setpoint.

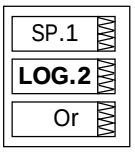
To select a setpoint parameter:

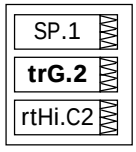
1. Press the SELECT button to activate the middle window.
2. Use the UP and DOWN arrow buttons to scroll to the desired parameter.



To change the parameter value:

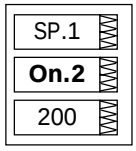
1. Press the SELECT button to activate the lower window.
2. Use the UP and DOWN arrow buttons to select the desired value.
3. Press ENTER to confirm the new parameter setting, or press ESC to discard changes.
4. You are returned to the middle window to select and configure another parameter, or confirm the setpoint settings and exit the menu.





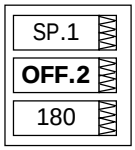
To store your new setpoint settings after you configured all setpoint parameters:

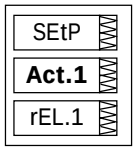
1. When the middle window is highlighted, press the ENTER button.
2. You are returned to the upper window to select another setpoint or exit the menu.



To exit the menu, press ESC.

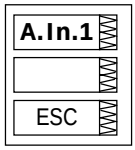
The following table lists available setpoint options. For a list of available setpoint triggers and actions, see Using Control Setpoints in Chapter 4.

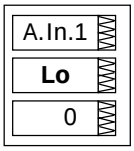


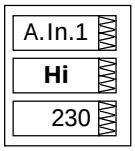


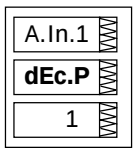
Label	Parameter	Options	Description
LGC.2-LGC.4	Logical operator	OR, AND	Combines setpoint triggers in a logical expression
TrG.1-TrG.4	Trigger parameter #1-#4	See Appendix C	The analog or digital value that is used as an argument in a logical expression
On.1-On.4	Operate limit		The threshold (in primary units) at which the conditional expression would be evaluated to true. Not applicable for digital triggers.
OFF.1-OFF.4	Release limit		The threshold (in primary units) at which the conditional expression would be evaluated to false. Defines the hysteresis for analog triggers. Not applicable for digital triggers.
Act.1-Act.4	Setpoint action #1-#4	See Appendix C	The action performed when the setpoint expression is evaluated to true (the setpoint is in operated state)
On d	Operate delay	0-999.9 sec	The time delay before operation when the operate conditions are fulfilled
OFF d	Release delay	0-999.9 sec	The time delay before release when the release conditions are fulfilled

Analog Inputs Setup









This entry appears only if the meter is ordered with optional analog inputs. For more information on configuring analog inputs in your meter, see Programming Analog Inputs in Chapter 4.

To enter the menu, select the “A.In.1” or “A.In.2” entry from the main menu for the AI1 and AI2 inputs respectively, and press the ENTER button.

To change the analog input options:

1. Use the UP and DOWN arrow buttons to scroll to the desired parameter.
2. Press the SELECT button to activate the lower window.
3. Use the UP and DOWN arrow buttons to adjust the parameter value.
4. Press ENTER to confirm the new parameter setting, or press ESC to discard changes.
5. You are returned to the middle window to select another parameter, or store your new settings and exit the menu.

To store new settings and exit the menu:

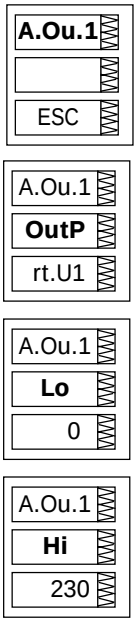
1. When the middle window is highlighted, press the ENTER button.
2. You return to the Main menu.

To exit the menu without saving your changes, press ESC.

The following table lists available analog input options.

Label	Parameter	Options	Description
Lo	Zero scale	0-999,999	The low engineering scale (in primary units) for the analog input corresponding to a lowest (zero) input current (0 or 4 mA)
Hi	Full scale	0-999,999	The high engineering scale (in primary units) for the analog input corresponding to a highest input current (1 or 20 mA)
dEc.P	Number of decimal places	0-3	The number of decimal digits in a fractional part of the scaled engineering value

Analog Outputs Setup



This entry appears only if the meter is ordered with optional analog outputs. For more information on configuring analog inputs in your meter, see Programming Analog Outputs in Chapter 4.

To enter the menu, select the “A.Ou.1” or “A.Ou.2” entry from the Main menu for the AO1 and AO2 output respectively, and then press the ENTER button.

To change the analog output options:

1. Use the UP and DOWN arrow buttons to scroll to the desired parameter.
2. Press the SELECT button to activate the lower window.
3. Use the UP and DOWN arrow buttons to adjust the parameter value.
4. Press ENTER to confirm the new parameter setting, or press ESC to discard changes.
5. You are returned to the middle window to select another parameter, or store your new settings and exit the menu.

To store new settings and exit the menu:

1. When the middle window is highlighted, press the ENTER button.
2. You return to the Main menu.

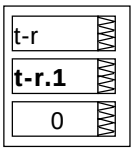
To exit the menu without saving your changes, press ESC.

The following table lists available analog output options. For a list of the available output parameters and their scales, see Programming Analog Outputs in Chapter 4.

Label	Parameter	Options	Description
OutP	Output parameter	See Appendix B	Selects the measured parameter to be transmitted through the analog output channel.
Lo	Zero scale		Low engineering scale (in primary units) for the analog output corresponding to a lowest (zero) output current (0 or 4 mA)
Hi	Full scale		High engineering scale (in primary units) for the analog output corresponding to a highest output current (1 or 20 mA)

Timers Setup

The PM175 is provided with four interval timers. When enabled, a timer generates periodic events in predefined intervals that can trigger setpoints to



produce periodic actions like periodic data trending. To enter the menu, select the “t-r” entry from the main menu and press the ENTER button.

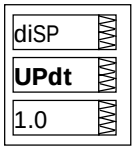
Use the UP and DOWN arrow buttons to scroll to the desired timer.

To change the time period for the timer:

1. Press the SELECT button to activate the lower window.
2. Use the UP and DOWN arrow buttons to enter the desired interval value in seconds. Intervals from 1 to 9999 seconds are allowed. Resetting the interval to 0 disables the timer.
3. Press ENTER to confirm your changes and to save the new settings, or press ESC to discard changes.
4. You are returned to the middle window to select another timer or exit the menu.

To exit the menu, press ESC.

Display Setup



This menu allows you to configure options for the meter display, and view display and device firmware versions. To enter the menu, select the “diSP” entry from the main menu and press the ENTER button.

To select a setup option:

1. Press the SELECT button to activate the middle window.
2. Use the UP and DOWN arrow buttons to scroll to the desired option.

To change the option:

1. Press the SELECT button to activate the lower window.
2. Use the UP and DOWN arrow buttons to select the desired option.
3. Press ENTER to confirm the changes and to save your new setting, or press ESC to discard changes.

To exit the menu, press ESC.

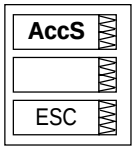
The following table lists available options.

Label	Parameter	Options	Default	Description
UPdt	Display update rate	0.1-10.0 sec	1 sec	Defines the interval between display updates
ScrL	Auto scroll interval	None, 2-15 sec	None	Defines the scroll interval for the main data display or disables auto scroll
rEtn	Auto return to the main screen	diS = disabled, En = Enabled	Enabled	Enables automatic return to the main display if no buttons are pressed for 5 minutes
bAr	Reference load current for LED bar graph	0-10,000A (0 = CT primary current)	0	Defines the nominal load (100%) level for the bar graph display
Uolt	Primary/Secondary volts units	Pri, SEc	Primary	Selects primary or secondary units for volts display
Ph.P	Phase powers display mode	diS, En	Disabled	Disables or enables phase powers in the main display
Fund.	Fundamental component display mode	diS, En	Disabled	Disables or enables fundamental values in the main display

Label	Parameter	Options	Default	Description
dAtE	Date order	dnY, ndY, Ynd (d=day, n=month, y=year)	mm.dd.yy	Defines the date order in the RTC display
rSt	Simple reset mode	PASS = password required En = enabled	PASS	PASS = the simple reset is not allowed when password protection is enabled En = enables the simple reset buttons regardless of password protection
SoFt.	Display firmware version	N/A	N/A	Shows display firmware version, like 1.2.8
SoFt.	Device firmware version	N/A	N/A	Shows device firmware version, like 15.01.09

Meter Security

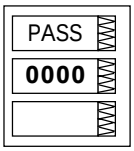
The Access Control menu allows you to change the user password and enable or disable password protection. To enter the menu, select the “AccS” entry from the main menu and press the ENTER button.



The password in your meter is preset to 0 at the factory, and password protection is disabled.

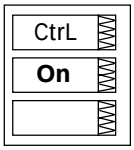
To change the password:

1. Select the “PASS” entry in the upper window with the UP and DOWN arrow buttons.
2. Press the SELECT button to activate the first password digit.
3. Use the UP and DOWN arrow buttons to adjust the digit.
4. Press the SELECT button to advance to the next digit.
5. Adjust the remaining password digits.
6. Press ENTER to confirm your new password.



△ Your new password is effective for both the display and communication ports.

To enable or disable password protection:

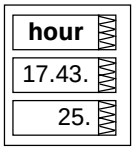


1. Select “CtrL” in the upper window using the UP and DOWN arrow buttons.
2. Press the SELECT button to activate the middle window.
3. Use the UP and DOWN arrow buttons to select the desired option. “On” enables password protection, “OFF’ disables password protection.
4. Press ENTER to confirm your new setting, or ESC to discard changes.

To exit the menu, press ESC.

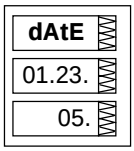
△ When password protection is enabled in your meter, you are not able to change the device settings through the display or communications unless you provide a correct password. If you cannot provide a proper password, contact your local distributor for the appropriate password to override password protection.

Setting the Device Clock



To enter the menu, select the “rtc” entry from the main menu and press the ENTER button. This menu allows you to set up the device clock and to configure your local time zone settings.

To select a setup option, use the UP and DOWN arrow buttons from the upper window.



To change the time, date, or daylight savings setting:

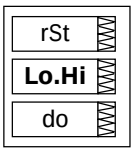
1. Highlight an item you want to change by pressing briefly the SELECT button. When you enter the time setup display, the hours and minutes are frozen to allow you to adjust them.
2. Adjust the selected item with the UP and DOWN arrow buttons.
3. Highlight the next item you want to change and adjust it in the same manner.
4. Press ENTER to confirm your changes, or press ESC to leave the clock settings unchanged. If you confirm the time change while the seconds are highlighted, the seconds are zeroed; otherwise they stay unchanged.

To exit the menu, press ESC.

The following table lists available options.

Label	Option	Format / Range	Description
hour	Time	hh.mm.ss	The time is displayed as hh.mm.ss, where the hours and minutes are shown in the middle window separated by a dot, and the seconds - in the lower window.
dAte	Date	YY.MM.DD, MM.DD.YY, DD.MM.YY	The date is displayed as per the user definition, where the first two items are shown in the middle window, and the last one - in the lower window. For instructions on how to select the date format, see “Display Setup”.
dAY	Day of week	Sun = Sunday Πon = Monday tuE = Tuesday UEd = Wednesday thu = Thursday Fri = Friday Sat = Saturday	The day of the week is displayed in the lower window. It is set automatically when you change the date.
dSt	Daylight savings time option	diS = disabled En = enabled	When DST is disabled, the RTC operates in standard time only. When enabled, the device automatically updates the time at 2:00 AM at the pre-defined DST switch dates.
dSt.S	DST start date	Month-week-weekday Week = 1st, 2nd, 3rd, 4thor LSt (last week of the month)	The date when Daylight Savings Time begins. The DST switch point is specified by the month, week of the month and weekday. By default, DST starts at 2:00 AM on the first Sunday in April of each year.
dSt.E	DST end date	Month-week-weekday Week = 1st, 2nd, 3rd, 4thor LSt (last week of the month)	The date when Daylight Savings Time ends. The DST switch point is specified by the month, week of the month and weekday. By default, DST ends at 2:00 AM on the last Sunday in October of each year.

Resetting Accumulators and Maximum Demands



To enter the menu, select the “rst” entry from the main menu, and then press the ENTER button.

The Reset menu allows you to separately reset minimum/maximum log records, maximum demands and counters.

To reset the desired registers:

1. Highlight the middle window by pressing briefly the SELECT button.
2. Select the desired entry by scrolling through the list with the UP and DOWN arrow buttons until the desired entry appears.
3. Press the SELECT button briefly to highlight the lower item.
4. Press and hold the ENTER button for 5 seconds.
5. Release the button. The “do” entry is replaced with “done” showing the operation is complete.

The following table shows available options.

Label	Description
Lo.Hi	Clears Min/Max log
A.dnd	Clears maximum ampere, volt and harmonic demands
P.dnd	Clears maximum power demands
dnd	Clears all maximum demands
Enr	Clears all total energies
tOU.d	Clears summary and TOU maximum demands
tOU.E	Clears summary and TOU energy registers
Cnt	Clears all counters
Cnt1 – Cnt4	Clears counter #1-#4

Chapter 4 PAS Application Software

Supplemental PAS software can be used for configuring the PM175 through communication ports, for retrieving real-time and recorded data, and for remote upgrading device firmware.

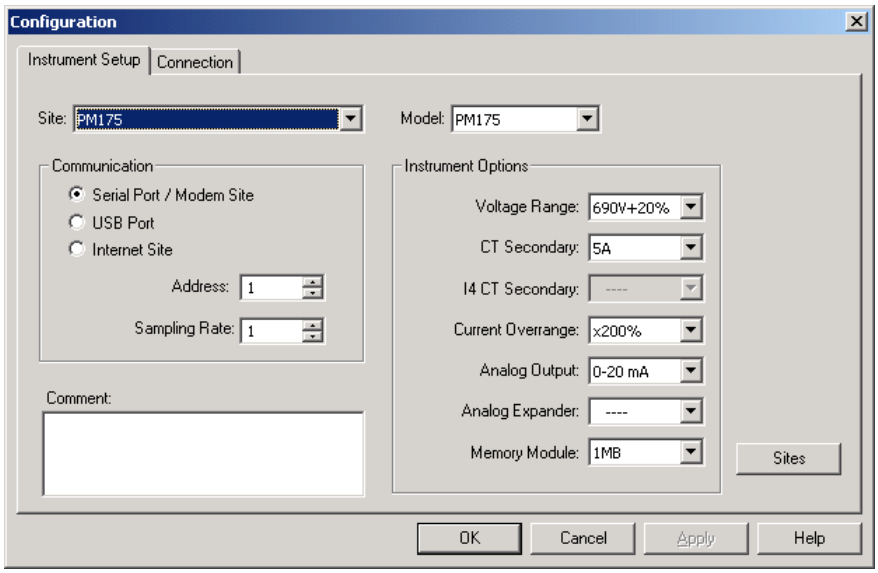
For information on how to install PAS on your PC, see the “PAS Getting Started” guide supplied on the installation CD.

Configuration Database

To communicate with your meters, create a separate site database for each device. All communication and configuration data for your meter is stored in this database. During configuration store all setup data to the site database so that PAS recognizes device properties regardless of whether the device is online or offline.

To create a new database for your meter:

1. Select Configuration from the Tools menu, and then click the Sites button on the right-hand-side.



2. From the “Look in” box, select the directory where a new database will be stored. By default, it will be the “Sites” directory. Type a site name for your device in the “File name” box, click New, and then click OK.
3. On the Instrument Setup tab, select “PM175” in the “Model” box. PAS automatically selects the appropriate instrument options for your meter.
4. Select a correct CT secondary current (5A or 1A) for your meter.
5. If you wish to add any comments for your meter, type them into the “Comment” box.

Setting up Communications

You can communicate with the meter via a changeable COM1 communication port, or through a second factory set serial RS-485/RS-422 COM2 port. Depending on what was ordered, your meter’s COM1 port can be equipped with an RS-232/RS-422/RS-485 serial interface, with a dial-up modem for communicating through public telephone lines, or with an Ethernet module for communicating through the Internet.

To configure your communications with the PM175:

1. Select Configuration from the Tools menu. Under the Communication group on the Instrument Setup tab, select the type of connection for your device.
2. Set the device communication address you assigned to the PM175.
3. In the “Sampling Rate” box, select a rate at which PAS updates data on your screen when you continuously poll the device in the PAS Data Monitor.

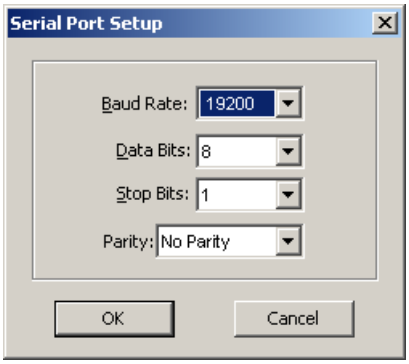
The communication protocol and port settings in PAS must match the settings made in your device.

Communicating through a Serial Port

Select Serial Port/Modem Site on the Configuration tab, and then click on the Connection tab to configure your serial port settings.

Configuring a Serial Port

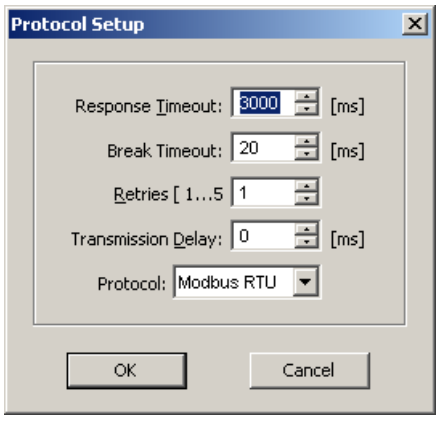
1. On the Connection tab, select a COM port from the “Device” box, and then click Configure.



2. Specify the baud rate and data format for the port. Choose the same baud rate and data format as you have set in the device, and then click OK. The default settings for the local RS-232 and RS-422/485 ports are 19200 baud, 8 bits with no parity.

Selecting the Communications Protocol

1. On the Connection tab, click Protocol.



2. In the “Protocol” box, select the same communications protocol as you have in your meter. The default protocol setting in your meter for all ports is Modbus RTU.

For more information on configuring the protocol parameters, refer to the “PAS Getting Started” guide.

Communicating through a Dial-up Modem

Configuring a Modem

1. On the Connection tab, select a local modem installed on your PC.
2. Click on Phones to add the phone number of the remote meter to the phone list.
3. Type the phone number in the “Phone number” box, add comments if you desire, click Add, and then click OK.
4. From the “Phone number” box on the Connection tab, select the phone number from the list, and then click OK.

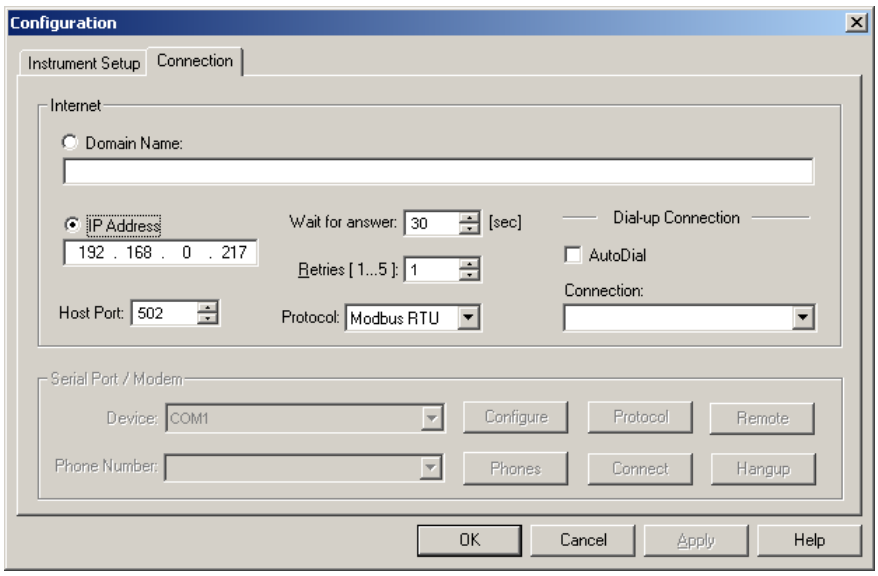
Selecting the Communications Protocol

On the Connection tab, click Protocol, and then select the protocol settings as shown above for a serial port.

Communicating through the Internet

If you are communicating through the Ethernet port, you should define the IP address of your meter on the network.

1. On the Instrument Setup tab, select Internet Site.
2. Click on the Connection tab.



3. Click on the “IP address” and type in the IP address of your meter. The default IP address preset at the factory is 192.168.0.203.
4. In the “Protocol” box, select the communications protocol for the TCP port. The meter provides Modbus/TCP connections on TCP port 502. The host port is set automatically as you select the protocol. Select “Modbus RTU” for Modbus/TCP.

5. In the “Wait for answer” box, adjust the time that PAS waits for a connection before announcing an error and the number of retries PAS uses to receive a response from the device if communications fail.

Setting Up the Meter

PAS allows you to prepare setup data for the meter off-line without the need to have it connected to your PC.

Select the device site from the list box on the PAS toolbar, and then select the desired setup group from the Meter Setup menu. Click on the tab with the setup you want to create or modify, and then fill in the boxes with the desired configuration data for your device. Click the “Save as…” button to store the data to the site database.

△ Always set up and store the Basic Setup data to the site database first. PAS uses this data as a reference when arranging other meter setup.

To save your setup to another site database, select it from the file pane. Click OK.

To reuse setups from another site, copy them to your present site database. Click Open, select the desired site database, and click OK. The opened setup is copied to your site database.

You can also copy all setups from one site database into another site's database. Select a device site from the list box on the toolbar from which you want to reproduce setups, and then select “Copy to...” from the Meter Setup menu. Select the site database to which to copy setups, and click OK.

Downloading Setup to the Meter

You can update each setup in your meter one at a time or download all setups together from the site database.

To update a particular setup in your device, check the On-line button on the PAS toolbar, select a meter site from the list box on the toolbar, and then select the desired setup group from the Meter Setup menu. Click on the tab of the setup you want to download to the meter, and then click Send.

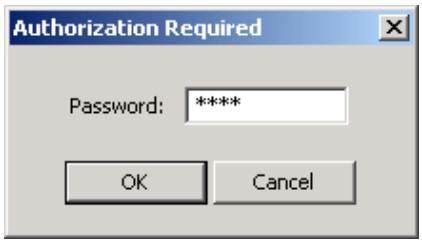
To download all setups to your device at once, check the On-line button on the toolbar, select the device site from the list box on the toolbar, and then select Download Setups from the Meter Setup menu.

Uploading Setup from the Meter

To upload the setup from the device to the site database, check the On-line button on the toolbar, select the device site from the list box on the toolbar, and then select Upload Setups from the Meter Setup menu.

Authorization

If communications with your device is secured, you are prompted for the password when you send new setup data to the meter.



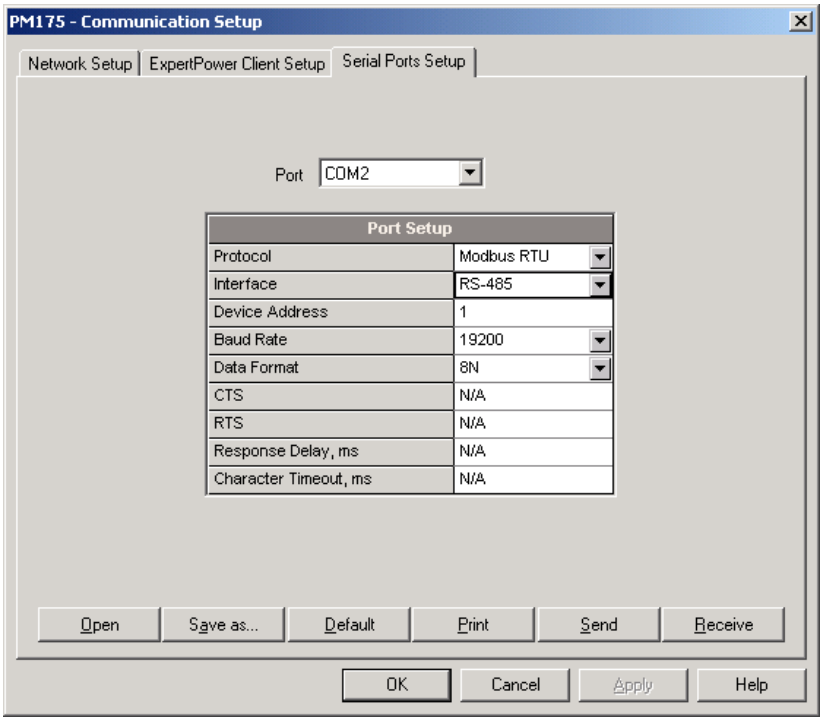
Enter the password and click OK. If your authorization was successful, you are not prompted for the password again until you close the dialog window.

Configuring Communications in your Meter

This section describes how to configure communication ports in your meter through PAS.

Setting Up Communication Ports

To enter the setup dialog, select the device site from the list box on the PAS toolbar, select Communications Setup from the Meter Setup menu, and then click on the Serial Ports Setup tab. In the Port box, select the desired device port.



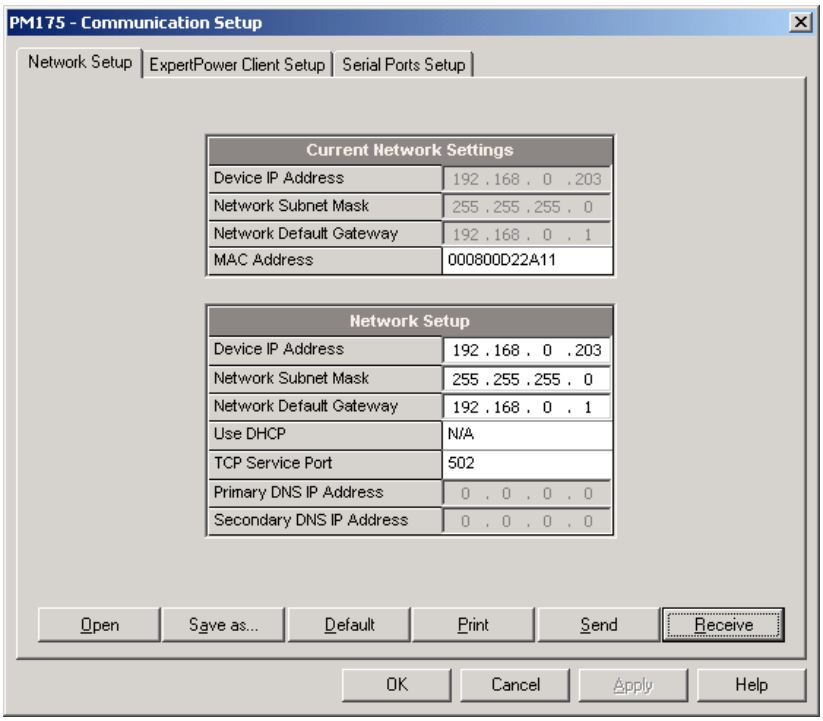
To change the port settings in your meter, select desired port parameters, and then click Send. For the available communication options, see Communication Ports in Chapter 3.

NOTE

When you change the COM1 settings in the meter through the Ethernet port, the device port restarts so communications will be temporarily lost. You may need to wait some additional time until PAS restores a connection with your device.

Setting Up the Ethernet

To enter the Setup dialog, select the device site from the list box on the PAS toolbar, select Communications Setup from the Meter Setup menu, and then click on the Network Setup tab.


PM175 - Communication Setup
Network Setup
ExpertPower Client Setup
Serial Ports Setup
Current Network Settings
Device IP Address 192 . 168 . 0 . 203
Network Subnet Mask 255 . 255 . 255 . 0
Network Default Gateway 192 . 168 . 0 . 1
MAC Address 000800D22A11
Network Setup
Device IP Address 192 . 168 . 0 . 203
Network Subnet Mask 255 . 255 . 255 . 0
Network Default Gateway 192 . 168 . 0 . 1
Use DHCP N/A
TCP Service Port 502
Primary DNS IP Address 0 . 0 . 0 . 0
Secondary DNS IP Address 0 . 0 . 0 . 0
Open
Save as...
Default
Print
Send
Receive
OK
Cancel
Apply
Help

The following table lists available network options.

Parameter	Options	Default
Device IP Address		192.168.0.203
Network Subnet Mask		255.255.255.0
Network Default Gateway		192.168.0.1
TCP Service Port	502 = Modbus/TCP	502

△ The TCP service port can also be changed trough the COM1 serial port setup: changing the protocol for the port automatically changes the TCP port for the Ethernet.

To change the Ethernet settings in your meter, select desired parameters, and then click Send.

NOTES

1. The meter provides the permanent Modbus TCP server on port 502.
2. When you change the device network settings through the Ethernet port, the device port restarts so communication will be temporarily lost. You may need to wait some additional time until PAS restores a connection with your device.

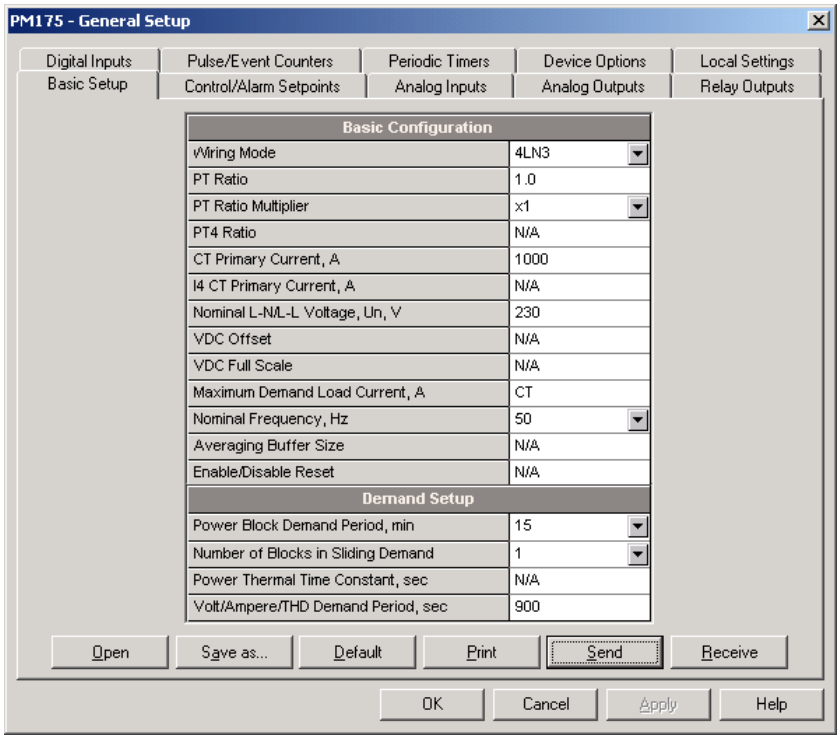
General Meter Setup

This section describes how to configure the PM175 for your particular environment and application using PAS.

Basic Meter Setup

Before operating your meter, provide the device with basic information about your electrical network.

To enter the Setup dialog, select the device site from the list box on the PAS toolbar, and then select General Setup from the Meter Setup menu.



The following table lists available device configuration options.

Parameter	Options	Default	Description
Basic Configuration			
Wiring mode	See Table below	4LN3	The wiring connection of the device
PT ratio[1]	1.0-6500.0	1.0	The phase potential transformer's primary to secondary ratio
PT Ratio multiplier	×1, ×10	×1	PT Ratio multiplication factor. Used in extra high voltage networks to accommodate the PT ratio for 500 kV and higher networks.
CT primary current	1-10000 A	5 A	The primary rating of the phase current transformer
Nominal voltage	10-690 V	120 V	The nominal secondary line-to-neutral (in 4LN3, 3LN3 and 3BLN3 wiring modes) or line-to-line (in 4LL3, 3LL3, 3BLL3, 3OP2, 3OP3 and 3DIR modes) voltage. Used as a reference voltage for the EN50160 evaluation.
Maximum demand load current	0-10000 A	0	The maximum demand load current (0 = CT primary)
Nominal frequency	50,60 Hz	60 Hz	The nominal line frequency
Demand Setup			
Power block demand period	1, 2, 5, 10, 15, 20, 30, 60 min, E=external sync	30 min	The length of the demand period for power demand calculations. If the external synchronization is selected, a pulse front on the digital input DI1 denotes the start of the demand interval.
Number of blocks in sliding demand	1-15	1	The number of blocks to be averaged for sliding window demands
Volt/Ampere/THD demand period	0-1800 sec	900 sec	The length of the demand period for ampere, volt and THD demand calculations

[1] PT Ratio is defined as a relation of the potential transformer's primary voltage rating to its secondary rating. For example, for the 14,400 V transformer's primary rating and 120 V secondary rating, the PT Ratio = 14400/120 = 120.

Available wiring modes are listed in the following table.

Wiring Mode	Description
3OP2	3-wire Open Delta using 2 CTs (2 element)
4LN3	4-wire Wye using 3 PTs (3 element), line-to-neutral voltage readings
3DIR2	3-wire Direct Connection using 2 CTs (2 element)
4LL3	4-wire Wye using 3 PTs (3 element), line-to-line voltage readings
3OP3	3-wire Open Delta using 3 CTs (2½ element)
3LN3	4-wire Wye using 2 PTs (2½ element), line-to-neutral voltage readings
3LL3	4-wire Wye using 2 PTs (2½ element), line-to-line voltage readings
3BLN3	3-wire Broken Delta using 2 PTs, 3 CTs (2½-element), line-to-neutral voltage readings
3BLL3	3-wire Broken Delta using 2 PTs, 3 CTs (2½-element), line-to-line voltage readings

△ In 4LN3, 3LN3 and 3BLN3 wiring modes, the voltage readings for min/max volts and volt demands represent line-to-neutral voltages; otherwise, they will be line-to-line voltages. The voltage waveforms and harmonics in 4LN3, 3LN3 and 3BLN3 wiring modes represent line-to-neutral voltages; otherwise, they will be line-to-line voltages.

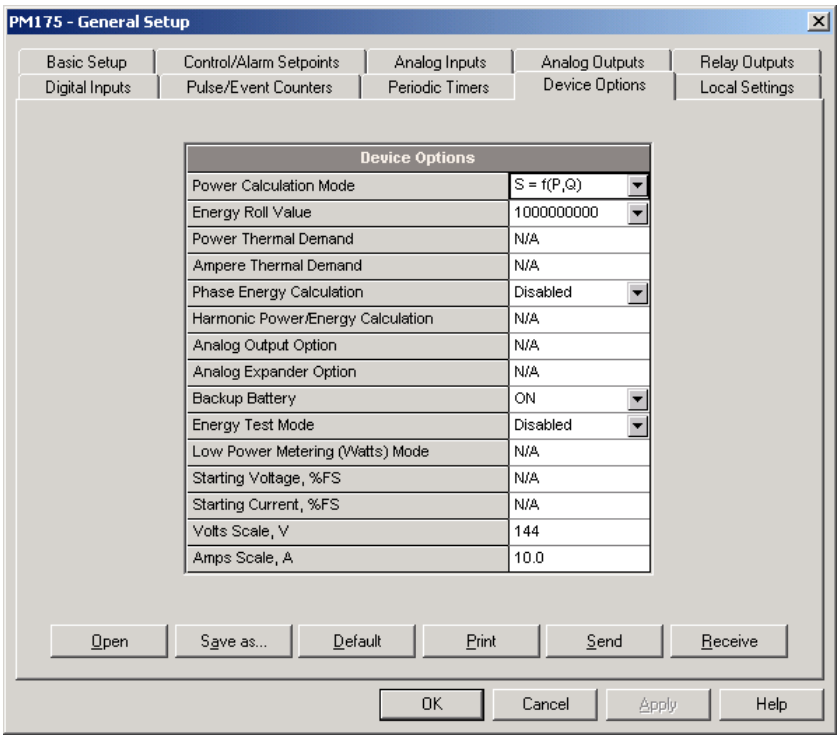
Device Options

This setup allows you to enable or disable optional calculations and redefine user-selectable device options.

To enter the setup dialog, select the device site from the list box on the PAS toolbar, select General Setup from the Meter Setup menu, and then click on the Device Options tab.

The following table lists available device options.

Parameter	Options	Default	Description
Power Calculation Mode	S=f(P, Q) (using reactive power), Q=f(S, P) (using non-active power)	S=f(P, Q)	The method used for calculating reactive and apparent powers (see "Power Calculation Modes" below)
Energy Roll Value	1000.0 kWh 10000.0 kWh 100000.0 kWh 1000000.0 kWh 10000000.0 kWh 100000000.0 kWh	100000000.0	The value at which energy counters roll over to zero
Phase Energy Calculation	Disabled, Enabled	Disabled	Enables phase energy calculations
Backup Battery	OFF = switched OFF On = switched ON	OFF	Allows to conserve a battery while the meter is out of operation
Energy Test Mode	OFF = disabled Wh pulses varh pulses	Disabled	Setting this option puts the meter into the energy test mode
Volts Scale, V	10-828 V	144 V	The maximum voltage scale allowed, in secondary volts. See "Device Scales" below
Amps Scale, A	2 × nominal CT secondary current (2A, 10A)	2A/10 A	The maximum current scale allowed, in secondary amps. Not changeable. See "Device Scales" below



Power Calculation Modes

The power calculation mode option allows you to change the method for calculating reactive and apparent powers in presence of high harmonics. The options work as follows:

1. When the reactive power calculation mode is selected, active and reactive powers are measured directly and apparent power is calculated as:

$$S = \sqrt{P^2 + Q^2}$$

This mode is recommended for electrical networks with low harmonic distortion, commonly with THD < 5% for volts, and THD < 10% for currents. In networks with high harmonics, the following method is preferable.

2. When the non-active power calculation mode is selected, active power is measured directly, apparent power is taken as product S = V x I, where V and I are the RMS volts and amps, and reactive power (called non-active power) is calculated as:

$$N = \sqrt{S^2 - P^2}$$

Device Scales

The maximum values for volts, amps and power in the meter setup and in communication are limited by the volts and amps scale settings. The following table shows the scales used by the meter.

Scale	Conditions	Range
Maximum voltage (V max)	All configurations	Voltage scale × PT Ratio, V
Maximum current (I max)	All configurations	Current scale (2A/10A) × CT Ratio = CT Primary current × 2, A [1]
Maximum Power	Wiring 4LN3, 3LN3, 3BLN3	V max × I max × 3, W
	Wiring 4LL3, 3LL3, 3BLL3, 3OP2, 3OP3, 3DIR2	V max × I max × 2, W

Maximum frequency	50 or 60 Hz	100 Hz

[1] CT Ratio = CT primary current/CT secondary current

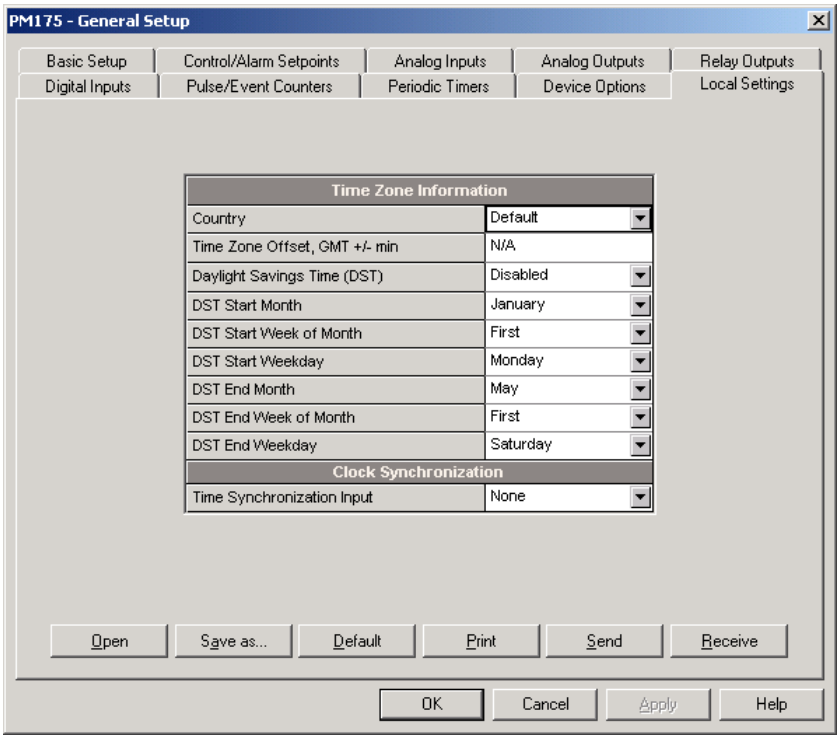
The default voltage scale in the meter is 144V. The recommended voltage scale is 120V+20% = 144V for using with external PT's, and 690V+20% = 828V for a direct connection to power line.

Maximum power is rounded to whole kilowatts. With PT=1.0, it is limited to 9,999,000 W.

Local Settings

This setup allows you to specify your time zone and daylight savings time options.

To configure the time zone options for your device, select the device site from the list box on the PAS toolbar, select General Setup from the Meter Setup menu, and then click on the Local Settings tab.



The available options are described in the following table:

Parameter	Options	Default	Description
Country	Default, or country name	Default	Defines calendar setting. The default setting stands for the U.S.A.
Daylight savings time	Disabled Enabled	Enabled	When DST is disabled, the RTC operates in standard time only. When enabled, the device automatically updates the time at 2:00 AM at the pre-defined DST switch dates.
DST start month DST start week DST start weekday	Month-week-weekday Week = 1st, 2nd, 3rd, 4thor Last (last week of the month)	First Sunday in April	The date when Daylight Savings Time begins. The DST switch point is specified by the month, week of the month and weekday. By default, DST starts at 2:00 AM on the first Sunday in April of each year.

Parameter	Options	Default	Description
DST end month DST end week DST end weekday	Month-week-weekday Week = 1st, 2nd, 3rd, 4thor Last (last week of the month)	Last Sunday in October	The date when Daylight Savings Time ends. The DST switch point is specified by the month, week of the month and weekday. By default, DST ends at 2:00 AM on the last Sunday in October of each year.
Time synchronization input	None DI1 DI2	None	The external port receiving the time synchronization pulses

Daylight Savings Time

The daylight savings time option is enabled in the PM175 by default, and the default daylight savings time change points are preset for the U.S.A. When the daylight savings time is enabled, the meter automatically adjusts the device clock at 02.00 AM when daylight savings time begins/ends.

If the daylight savings time option is disabled, you need to manually adjust the device clock for daylight savings time.

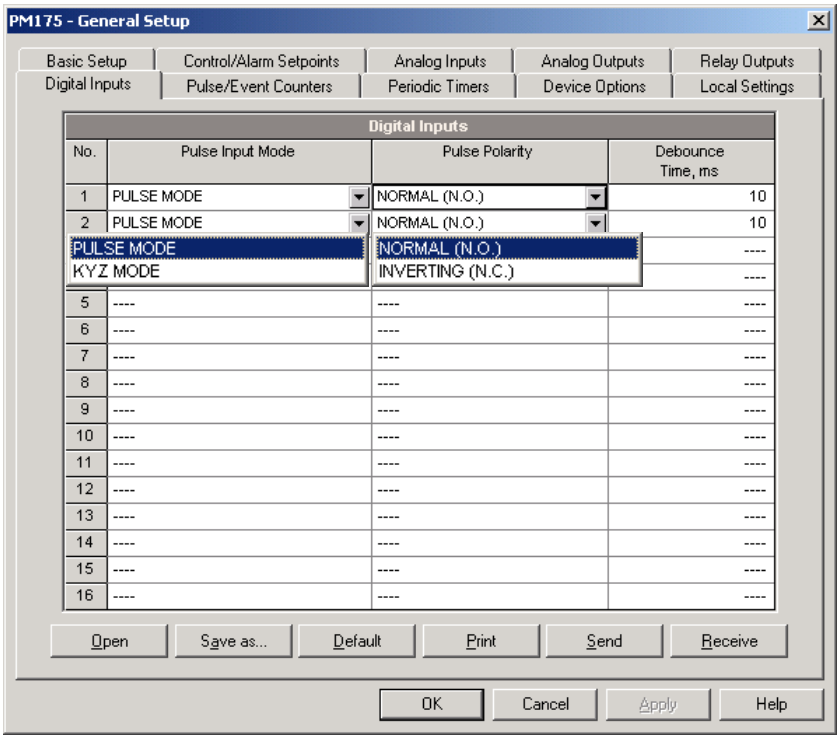
Time Synchronization Pulses

External time synchronization pulses can be delivered through one of the digital inputs. If a digital input is selected as the time synchronization source, the edge of an external pulse adjusts the device clock at the nearest whole minute. The time accuracy could be affected by the debounce time of the digital input, and by the operation delay of the external relay.

Using Digital Inputs

The meter is provided with two digital inputs that can trigger the alarm/control setpoints to give an alarm on input status change, or can be linked to the energy/TOU registers to count pulses from external watt meters, or gas and water meters.

To configure them in your device, select the device site from the list box on the PAS toolbar, select General Setup from the Meter Setup menu, and then click on the Digital Inputs tab.



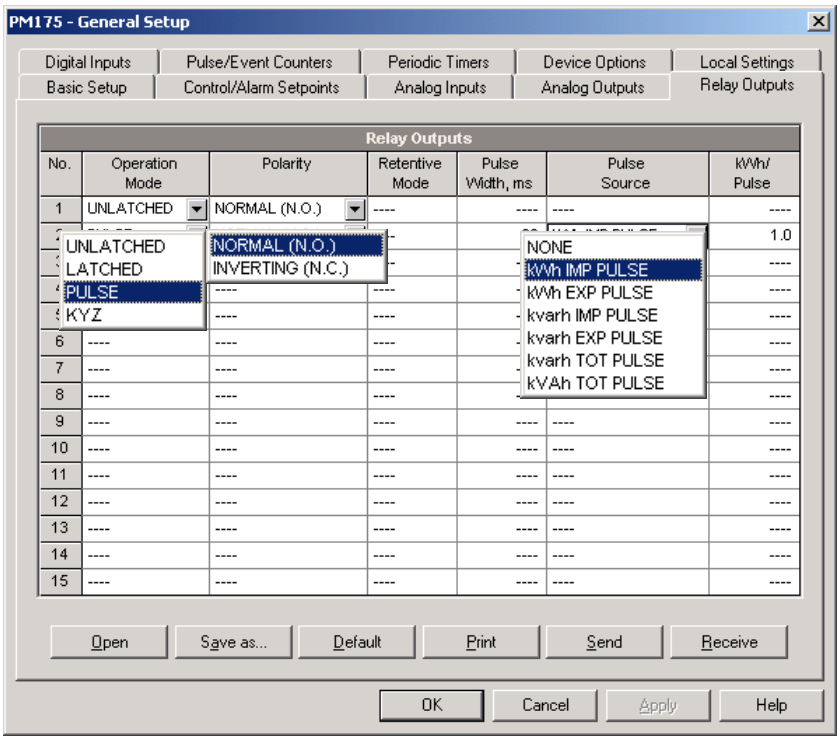
The available options are shown in the following table.

Parameter	Options	Default	Description
Pulse input mode	PULSE MODE, KYZ MODE	PULSE MODE	In pulse mode, either leading, or trailing edge of the input pulse is recognized as an event. In KYZ mode, both leading and trailing edges of the input pulse are recognized as separate events.
Pulse polarity	NORMAL (N.O.), INVERTING (N.C.)	NORMAL	For the normal polarity, the open to closed transition is considered a pulse. For the inverting polarity, the closed to open transition is considered a pulse. It has no meaning in KYZ mode where both transitions are used.
Debounce time	1-1000 ms	10 ms	The amount of time while the state of the digital input should not change to be recognized as a new state. Too low debounce time could produce multiple events on the input change.

The debounce time is used the same for both digital inputs. If you change the debounce time for one digital input, the same debounce time is automatically assigned to the other.

Using Relay Outputs

The PM175 is equipped with two relays. Each relay can be operated either locally from the alarm/control setpoints in response to an external event, or by a remote command sent through communications, and can also be linked to an internal pulse source to produce energy pulses.



The available relay options are shown in the following table:

Parameter	Options	Default	Description
Operation mode	UNLATHCED LATCHED PULSE KYZ	UNLATCHED	Unlatched mode: the relay goes into its active state when the control setpoint is in active (operated) state, and returns into its non-active state when the setpoint is released. Latched mode: the relay goes into its active state when the control setpoint goes into active state and remains in the active state until it is returned into its non-active state by a remote command. Pulse mode: the relay goes into its active state for the specified time, goes into non-active state for the specified time and remains in the non-active state. KYZ mode: the relay generates transition pulses. The relay output state is changed upon each command and remains in this state until the next command.
Polarity	NORMAL (N.O.) INVERTING (N.C.)	NORMAL	With normal polarity, the relay is normally de-energized in its non-active state and is energized in its active (operated) state. With inverting polarity, the relay is normally energized in its non-active state and is de-energized in its active (operated) state. It is called failsafe relay operation.
Retentive mode	NO YES	NO	Applicable for latched relays. In non-retentive mode, the relay always returns to its non-active state upon power up. In retentive mode, the relay status is restored to what it was prior to loss of power.
Pulse width	20-1000 ms	100 ms	The actual pulse width is a multiple of the 1/2-cycle time rounded to the nearest bigger value. The pause time between pulses is equal to the pulse width.
Pulse source	NONE kWh IMP kWh EXP kvarh IMP kvarh EXP kvarh TOT kVAh	NONE	Links a pulse relay to the internal energy pulse source. The relay must be set into either pulse, or KYZ mode.
Pulse rate, kWh/Pulse	0.1-1000.0	1.0 kWh/Pulse	Defines the pulse weight in kWh units per pulse

Generating Energy Pulses through Relay Outputs

To generate energy pulses through a relay output:

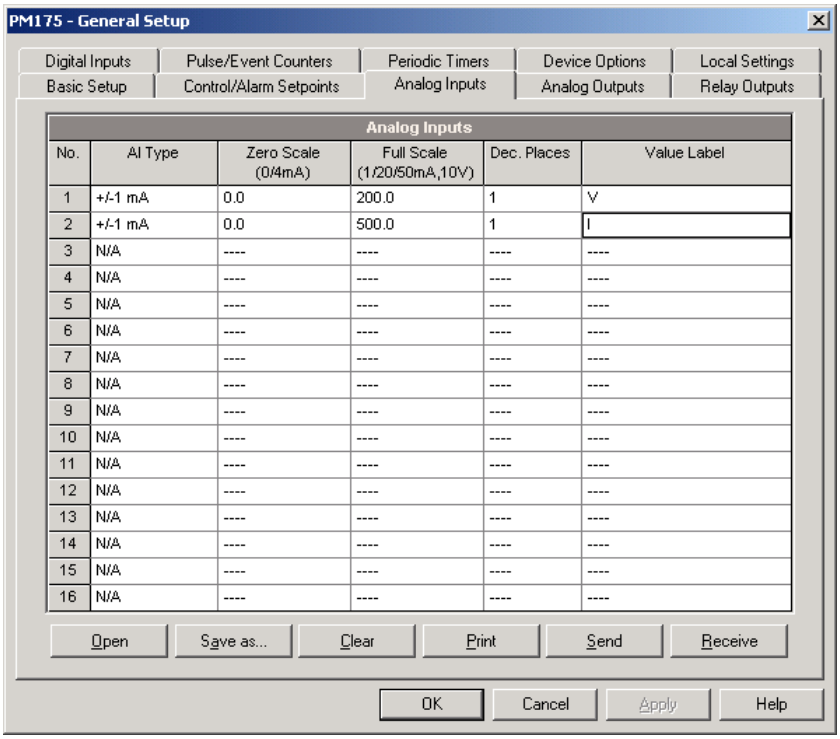
1. Set a relay to either pulse, or KYZ mode, and then select a polarity (active pulse edge) for energy pulses and a pulse width.
2. Select a source accumulator (type of energy) and the pulse rate for your output.
3. Store your new setup to the device.

Programming Analog Inputs

The PM175 can be provided with two optional analog inputs with options for 0-1mA, ±1mA, 0-20mA or 4-20mA input currents, depending on the order. The 0-1mA and ±1mA inputs can accept 100% overload currents, i.e., can actually measure currents in the range of 0-2 mA and ±2mA.

The meter automatically converts the analog input readings received from the analog-to-digital converter to the user-defined engineering scale and shows the input values in true engineering units, for example, in volts, amps, degrees, with the desired resolution.

To configure the Analog Inputs in your device, select General Setup from the Meter Setup menu, then click on the Analog Inputs tab. If you are programming your device online, analog inputs are designated as not available if they are not present in the device.



The available options are described in the following table.

Option	Range	Description
AI type	0-1mA ±1mA 0-20mA 4-20mA	The analog input type. When connected to the meter, shows the actual type received from the device. When working off-line, select the analog input option corresponding to your meter.
Zero scale	-999,999 to 999,999	Defines the low engineering scale (in primary units) for the analog input corresponding to a lowest (zero) input current (0 or 4 mA)
Full scale	-999,999 to 999,999	Defines the high engineering scale (in primary units) for the analog input corresponding to a highest input current (1 or 20 mA)
Dec. Places	0-3	The number of decimal digits in a fractional part of the scaled engineering value
Value label		An arbitrary name you can give the analog input value

Always save your analog inputs setup to the site database in order to keep the labels you give the analog inputs. They are not stored in your device.

Scaling Non-directional Analog Inputs

For non-directional analog inputs with the 0-1mA, 0-20mA and 4-20mA current options, provide both zero and full engineering scales. Each of the scales operates independently.

Scaling ±1 mA Analog Inputs

For directional ±1 mA analog inputs, you should provide only the engineering scale for the +1 mA input current. The engineering scale for the 0 mA input current is always equal to zero. The device does not allow you to access this setting. Whenever the direction of the input current is changed to negative, the device automatically uses your full engineering scale settings for +1 mA with a negative sign.

Scaling Analog Inputs for 0-2 mA and ±2 mA

The input scales for 0-1 mA and ±1 mA analog inputs are always programmed for 0 mA and +1 mA regardless of the desired input range. If you want to use the entire input range of 2 mA or ±2 mA, set the analog input scales in your device as follows:

0-2 mA: set the 1 mA scale to 1/2 of the required full scale output for uni-directional parameters, and set the 0 mA scale to the negative full scale and the 1 mA scale to zero for bi-directional parameters.

±2 mA: set the 1 mA scale to 1/2 of the required full-scale output for both uni-directional and bi-directional parameters.

For example, to convert voltage readings from the analog transducer that transmits them in the range of 0 to 2 mA to the range 0 to 120V, set the full range for the +1 mA analog input to 60V; then the 2 mA reading is scaled to 120V.

Programming Analog Outputs

The meter can be ordered with two optional analog outputs with options for 0-1mA, ±1mA, 0-20mA or 4-20mA output currents.

The 0-1mA and ±1mA current outputs provide a 100% overload, and actually output currents up to 2 mA and ±2mA whenever the output value exceeds the engineering scale set for the 1 mA or ±1mA.

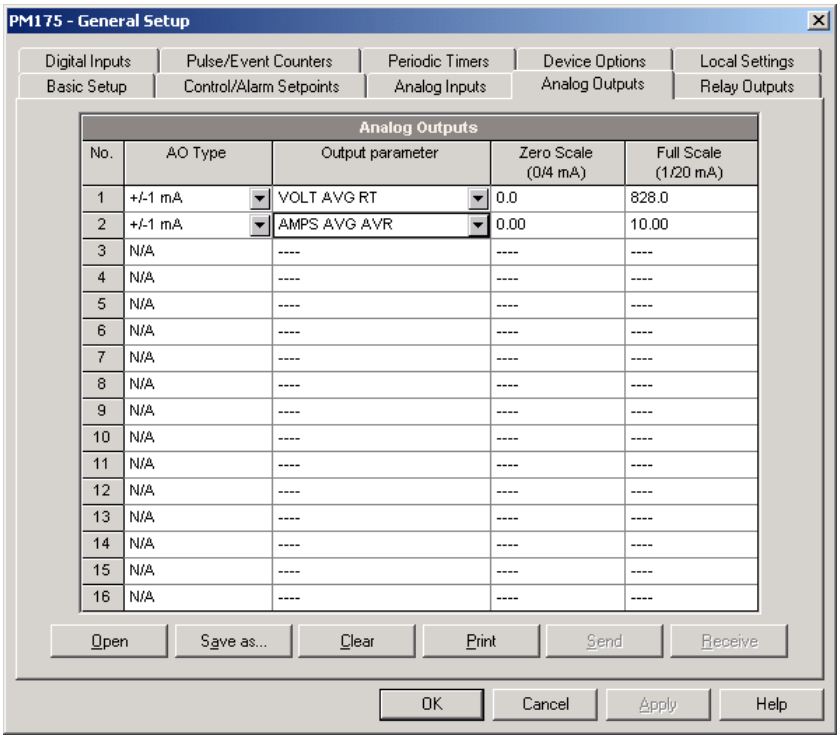
To configure the Analog Outputs in your device, select General Setup from the Meter Setup menu, then click on the Analog Outputs tab. If you are programming your device online, analog outputs are designated as not available if they are not present in the device.

The available analog output options are described in the following table.

Option	Range	Description
AO type	0-1mA ±1mA 0-20mA 4-20mA	The analog output type. When connected to the meter, shows the actual AO type read from the device. When working off-line, select the analog output option corresponding to your meter.
Output parameter	See Appendix B	Selects the measured parameter to be transmitted through the analog output channel.
Zero scale		Defines the low engineering scale (in primary units) for the analog output corresponding to a lowest (zero) output current (0 or 4 mA)
Full scale		Defines the high engineering scale (in primary units) for the analog output corresponding to a highest output current (1 or 20 mA)

When you select an output parameter for the analog output channel, the default engineering scales are set automatically. They represent the maximum available scales. If the parameter actually covers a lower range,

you can change the scales to provide a better resolution on the analog outputs.



Scaling Non-directional Analog Outputs

When programming scales for non-directional analog outputs with a 0-1mA, 0-20mA or 4-20mA current option, you can change both zero and full engineering scales for any parameter. The engineering scale need not be symmetrical.

Scaling Directional Power Factor

The engineering scale for the signed power factor emulates analog power factor meters. The power factor scale is -0 to +0 and is symmetrical with regard to ±1.000 (-1.000 ≡ +1.000). Negative power factor is scaled as -1.000 minus measured value, and non-negative power factor is scaled as +1.000 minus measured value. To define the entire power factor range from -0 to +0, the default scales are specified as -0.000 to 0.000.

Scaling ±1 mA Analog Outputs

Programming engineering scales for directional ±1mA analog outputs depends on whether the output parameter represents unsigned (as volts and amps) or signed (as powers and power factor) values.

If the output value is unsigned, you can change both zero and full engineering scales.

If the parameter represents a signed (directional) value, you should provide only the engineering scale for the +1 mA output current. The engineering scale for the 0 mA output current is always equal to zero for all values except the signed power factor, for which it is set to 1.000 (see “Scaling Directional Power Factor” above). The device does not allow you access to this setting if the parameter is directional. Whenever the sign of the output parameter is changed to negative, the device automatically uses your full engineering scale settings for +1 mA with a negative sign.

Scaling Analog Outputs for 0-2 mA and ±2 mA

The output scales for 0-1 mA and ±1 mA analog outputs are programmed for 0 mA and +1 mA regardless of the desired output current range. To use the entire output range of 2 mA or ±2 mA, set the analog output scales in your device as follows:

0-2 mA: set the 1 mA scale to 1/2 of the required full scale output for uni-directional parameters, and set the 0 mA scale to the negative full scale and the 1 mA scale to zero for bi-directional parameters.

±2 mA: set the 1 mA scale to 1/2 of the required full-scale output for both uni-directional and bi-directional parameters.

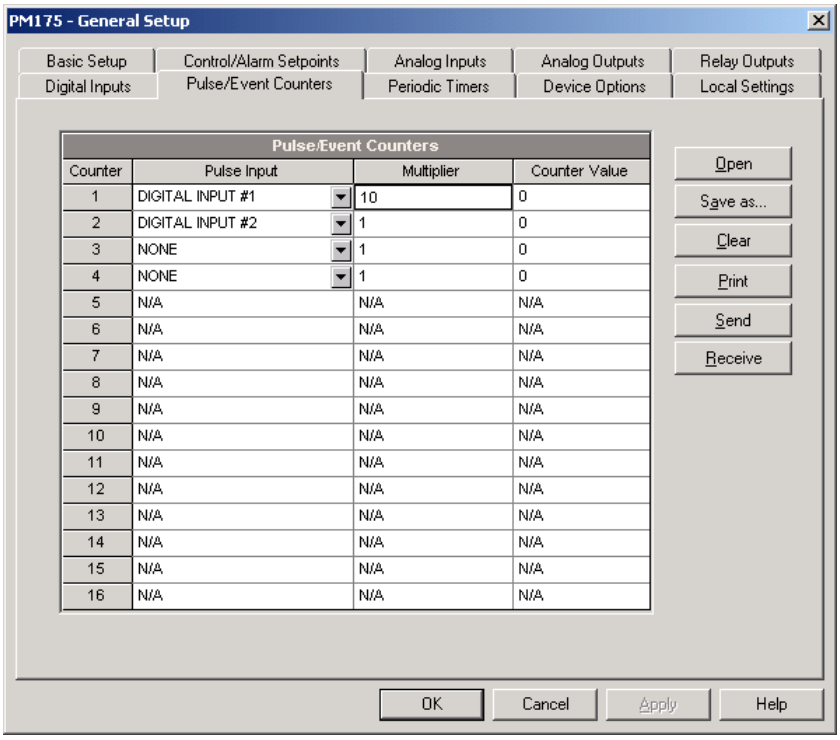
For example, to provide the 0 to 2 mA output current range for volts measured by the meter in the range of 0 to 120V, set the 1 mA scale to 60V; then the 120V reading will be scaled to 2 mA.

Using Counters

The meter provides four six-digit counters that count different events.

To configure the device counters, select General Setup from the Meter Setup menu, then click on the Pulse/Event Counters tab.

Each counter is independently linked to any digital input and count input pulses with a programmable scale factor. Each counter can also be incremented in response to any internal or external event, and checked and cleared through the Control Setpoints.



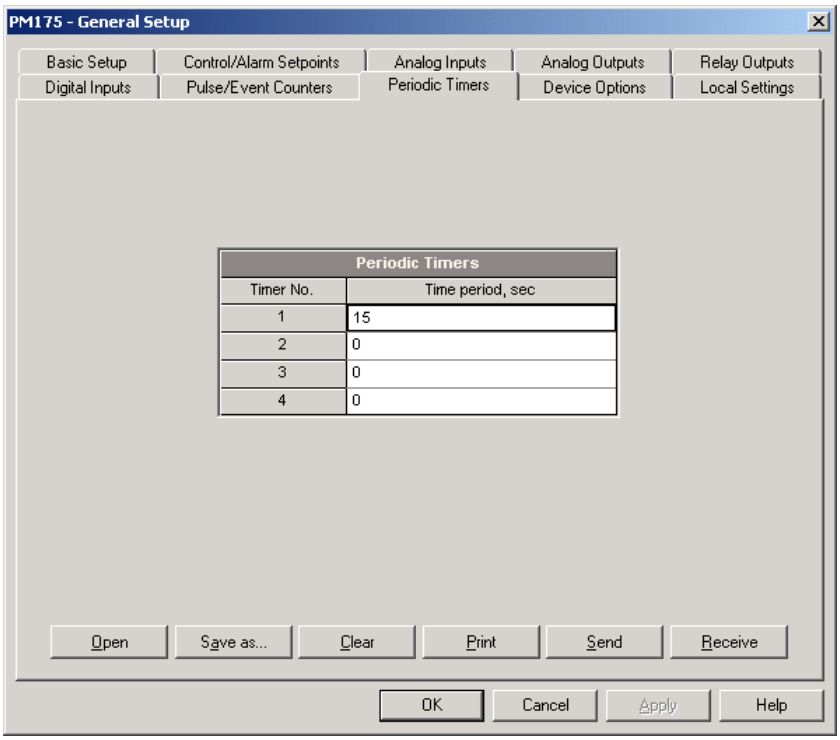
The following table lists available options.

Option	Range	Default	Description
Pulse Input	None, DI1-DI2	None	Links a digital input to the counter
Multiplier	1-9999	1	The value added to the counter when a pulse is detected on the pulse source input
Counter Value			Displays the present counter contents

You can preset a counter to a desired value or clear it through this dialog without affecting the counter setup. Check the Online button on the PAS toolbar before entering the setup dialog, type in the desired value into the Counter Value box, and then click Send.

Using Periodic Timers

The PM175 provides two programmable interval timers that can be used for periodic recording and triggering operations on a time basis via the Control Setpoints. When a timer interval expires, the timer generates an internal event that can trigger any setpoint (see Using Control Setpoints).



To configure the device timers, select General Setup from the Meter Setup menu, and then click on the Periodic Timers tab.

To run a periodic timer, specify a non-zero time period for the timer. The time period can be set from 1 to 9999 seconds.

To stop a timer, set the time period to zero.

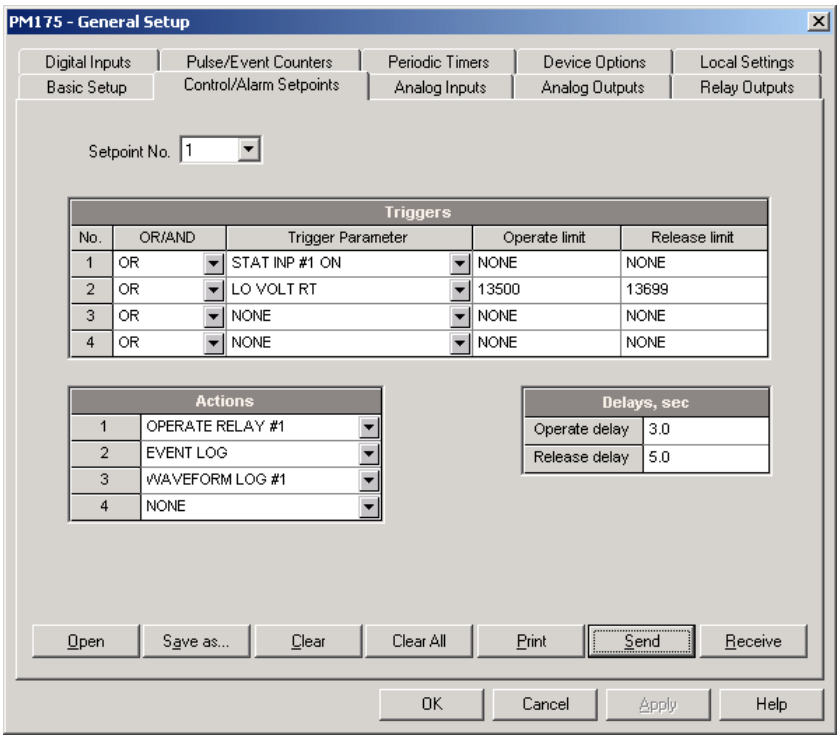
Using Control Setpoints

The PM175 has an embedded logical controller that runs different actions in response to user-defined internal and external events. Unlike a PLC, the meter uses a simplified programming technique based on setpoints that allows the user to define a logical expression based on measured analog and digital values that produce a required action.

The meter provides 16 control setpoints with programmable operate and release delays. Each setpoint evaluates a logical expression with up to four arguments using OR/AND logic. Whenever an expression is evaluated as “true”, the setpoint performs up to four concurrent actions that can send a command to the output relays, increment or decrement a counter, or trigger a recorder.

The logical controller provides very fast response to events. The scan time for all setpoints is 1/2 cycle time (8.8 ms at 60Hz and 10 ms at 50 Hz).

To program the setpoints, select General Setup from the Meter Setup menu, and then click on the Control/Alarm Setpoints tab.



The available setpoint options are described in the following table.

Option	Range	Description
Triggers		
OR/AND	OR, AND	The logical operator for the trigger
Trigger parameter	See Appendix C	The trigger parameter that is used as an argument in the logical expression
Operate limit		The threshold (in primary units) at which the conditional expression would be evaluated to true. Not applicable for digital triggers.
Release limit		The threshold (in primary units) at which the conditional expression would be evaluated to false. Defines the hysteresis for analog triggers. Not applicable for digital triggers.
Actions		
Action	See Appendix C	The action performed when the setpoint expression is evaluated to true (the setpoint is in operated state)
Delays		
Operate delay	0.1-999.9 sec	The time delay before operation when the operate conditions are fulfilled
Release delay	0.1-999.9 sec	The time delay before release when the release conditions are fulfilled

Setpoint #1 is factory preset to provide standard periodic data logs on a 15-minute time basis. It is linked to the device clock and runs data logs #1 and #2 at 15-minute boundaries of an hour.

Using Logical Expressions

Logical operators OR/AND are treated in a simplified manner. They have no specific priority or precedence rules.

Any trigger condition bound to the logical expression by the OR operator and evaluated as “true” will override any preceding condition evaluated as “false”. Similarly, any trigger condition evaluated as “false” and bound by the AND operator will override any condition evaluated before it as “true”.

To avoid confusion, it is recommended not to alternate different logical operators in one expression. Instead, bring all conditions that use the same logical operator together at one side of the expression, and the others - at the opposite side.

To explicitly override all other conditions with the critical trigger, put it at the end of the expression using the OR operator if you want the setpoint to be operated anyway when the trigger condition is asserted, and with the AND operator, if the setpoint should not be operated while the critical trigger is not asserted.

Using Numeric Triggers

For numeric (analog) triggers, a setpoint allows you to specify two thresholds for each trigger to provide hysteresis (dead band) for setpoint operations. The Operate Limit defines the operating threshold, and the second Release Limit defines the release threshold for the trigger. The trigger thresholds are specified in primary units.

If you do not want to use hysteresis for the trigger, set the Release Limit to the same as the Operate Limit.

Using Binary Triggers

Binary (digital) triggers, like digital inputs, relays, or internal static and pulsed events, are tested for ON (closed/set) or OFF (open/cleared) status.

The binary events are divided into two types: static events and pulsed events. Static events are level-sensitive events. A static event is asserted all the time while the corresponding condition exists. Examples are digital inputs, relays and event flags.

Pulsed events are edge-sensitive events with auto-reset. A pulsed event is generated for a trigger only once when a positive transition edge is detected on the trigger input. The examples of pulsed events are pulse inputs (transition pulses on the digital inputs), internal pulsed events (energy pulses and time interval pulses), and events generated by the interval timers. The logical controller automatically clears pulsed events at the end of each scan, so that triggers that used pulsed events are prevented from being triggered by the same event once again.

Using Event Flags

The PM175 provides 8 common binary flags, called event flags, which can be individually set, cleared and tested through setpoints and via communications.

Event flags can be used in different applications, for example, to transfer events between setpoints in order to expand a logical expression or a list of actions that have to be done for a specific event, or to externally trigger setpoint actions from the SCADA system or from a PLC through communications.

Using Interval Timers

The PM175 provides four interval timers that are commonly used for periodic recording of interval data at the time of the fault or in the presence of other events detected by a setpoint. The timers can be programmed to generate periodic events at user-defined intervals (see Using Periodic Timers).

Interval timers are not synchronized with the clock. When you run a timer, it generates a pulsed event that can trigger a setpoint if you have put the timer into a list of the setpoint triggers. When the setpoint event is asserted, the timer is restarted, and then generates the next event when the timer interval expires.

If you want to record interval data at predefined intervals without linking to other events, just select a timer as a setpoint trigger and specify a data log file you want to use for recording, in the setpoint actions list. If you want the periodic data to be recorded in presence of a specific event, select triggers

that will identify your event, and then add the timer at the end of the trigger list using the AND operator.

Using Time Triggers

If you want the setpoint actions to be synchronized with the clock, for example, to provide synchronous recording interval data each 15 minutes or each hour, or to output time pulses through relay contacts, use the time triggers that generate static events synchronized to the device clock.

You can exercise the default setting for Setpoint #1 in your device as an example of using time triggers. The setpoint is pre-programmed for data profiling at 15-minute intervals using data logs #1 and #2.

Delaying Setpoint Operations

Two optional delays can be added to each setpoint to extend monitoring setpoint triggers for a longer time before making a decision on whether the expected event occurred or not. When a delay is specified, the logical controller will change the setpoint status only if all conditions are asserted for a period at least as long as the delay time.

Note that you cannot use delays with pulsed events since they are cleared immediately and will no longer exist on the next setpoint scan.

Using Setpoint Events and Actions

When a setpoint status changes, i.e., a setpoint event is either asserted or de-asserted, the following happens in your device:

1. The new setpoint status is logged to the setpoint status register that can be monitored through communications from the SCADA system or from a programmable controller in order to give an indication on the expected event.
2. The operated setpoint status is latched to the setpoint alarm latch register accessible through communications. The register holds the last setpoint alarm status until it is explicitly cleared through communications.
3. Up to four programmable actions can be performed in sequence on setpoint status transition when a setpoint event is asserted.

Generally, setpoint actions are performed independently for each setpoint and can be repeated a number of times for the same target. The exceptions are relay operations, data logging and waveform logging that are shared for each separate target between all setpoints using an OR scheme.

A relay output is operated when one of the setpoints linked to the relay is activated and will stay in the operated state until all of these setpoints are released (except for latched relays that require a separate release command to be deactivated).

Data logging and waveform logging directed to the same file are done once for the first setpoint among those that specify the same action, guaranteeing that there will not be repeated records related to the same time.

Recording Setpoint Events

Time-tagged setpoint events can be recorded to the device Event log if you put a corresponding action into the setpoint action list. The Event recorder will log any setpoint transition event: both when the setpoint is operated, and when it is released. The Event recorder will put into a log file a separate record for each active trigger caused a setpoint status transition, and a separate record for each action done on the setpoint activation (except for data logging actions that are not recorded to the Event log).

Configuring Summary Energy and TOU Registers

The PM175 provides 8 total (summary) energy and 8 concurrent tariff energy and maximum demand registers that can be linked to any internal energy source or to any external pulse source that delivers pulses through the device digital inputs.

The meter tariff structure supports 8 different tariffs using an arbitrary tariff schedule. A total of 4 types of days and 4 seasons are supported with up to eight tariff changes per day.

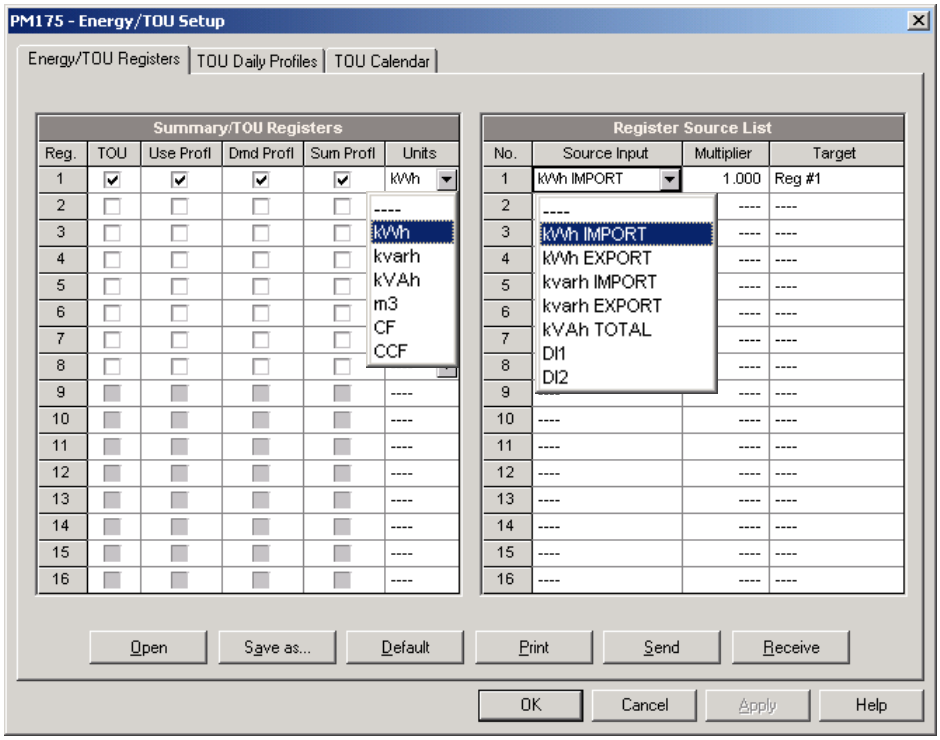
The meter can provide automatic daily profile recording for total and tariff energy and maximum demand registers.

By default, the billing registers in your meter and the tariff system are not operational. To activate the summary/tariff registers or to change the profile for the first billing register:

1. Link the billing registers to the respective energy sources, and then configure the options for these registers like whether the only totalization or both total and tariff registers would be used, and whether daily profiling should be enabled for the energy usage and maximum demand registers.
2. Configure the daily tariff schedule using the TOU daily profiles for all types of days and seasons.
3. Configure the season tariff schedule using the TOU calendar.

Setting up Total and Tariff Registers

To configure the device total (summary) and TOU registers, select Energy/TOU from the Meter Setup menu.

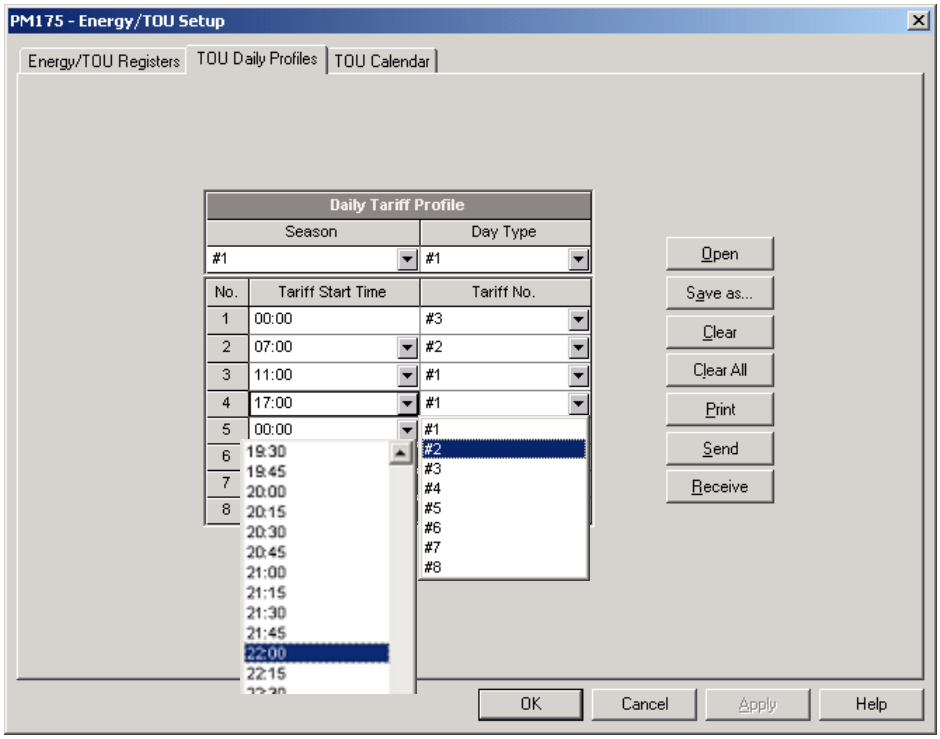


The available options are shown in the following table:

Parameter	Options	Default	Description
Summary/TOU Registers			
TOU	Unchecked Checked	Unchecked	Links tariff registers to the selected energy source
Use Profl	Unchecked Checked	Unchecked	Enables automatic daily profiling for energy usage registers (both total and tariff registers if TOU is enabled)
Dmd Profl	Unchecked Checked	Unchecked	Enables automatic daily profiling for maximum demand registers (both total and tariff registers if TOU is enabled)
Sum Profl	Unchecked Checked	Unchecked	Enables daily profiling for summary registers (total of all tariffs)
Units	kWh, kvarh, kVAh, m^3, CF (cubic foot), CCF (hundred cubic feet)	None	The register measurement units. When a register is linked to an internal energy source, it is set automatically. When an external pulse source is used, the user can select a measurement unit for the register.
Register Source List			
Source Input	None kWh Import kWh Export kvarh Import kvarh Export kVAh, DI1-DI2	None	Links an energy source to the register
Multiplier	0.001 to 100.000	1.000	The multiplication factor for the energy source.
Target	Reg#1- Reg#8	None	Defines the target billing register for the energy source. It is set automatically.

Configuring the Daily Tariff Schedule

To configure your daily tariff schedule, select Energy/TOU from the Meter Setup menu, and then click on the TOU Daily Profiles tab.



The daily profile setup allows you to specify the daily tariff change points with a 15-minute resolution for 4 seasons using 4 different daily schedules for each season.

To configure your daily profiles:

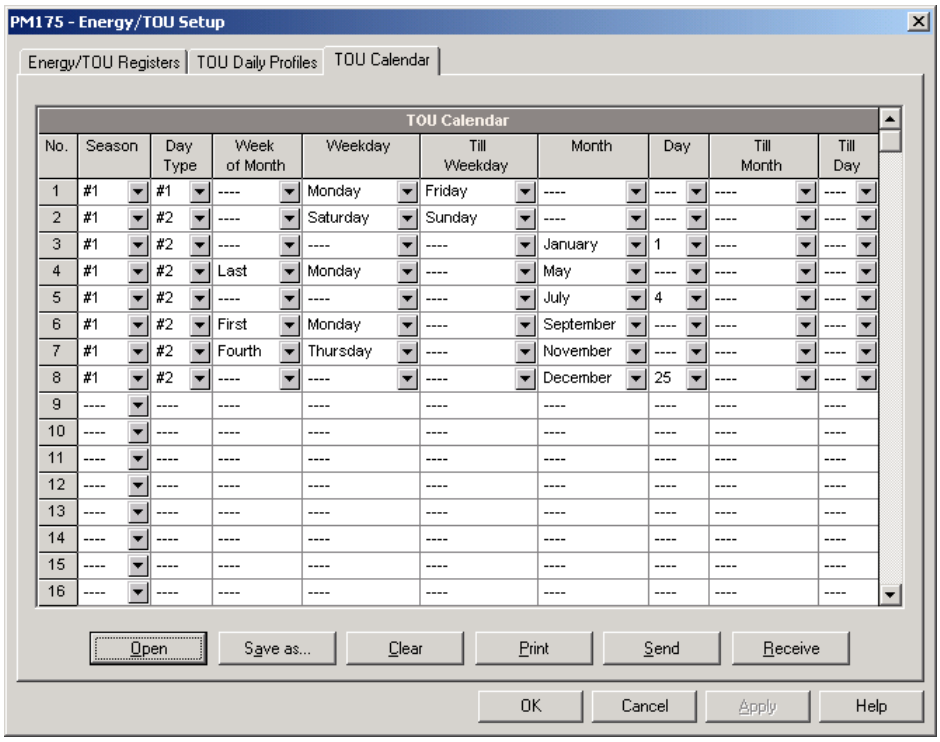
1. Select the desired season and day type.
2. Select the start time for each tariff change point and the corresponding active tariff number.
3. Repeat the setup for all active profiles.

The first tariff change point is fixed at 00:00 hours, and the last tariff change you specified will be in use until 00:00 hours on the next day.

The energy daily profile log will be automatically configured for the number of active tariffs you defined in the meter TOU daily profile.

Configuring the Season Tariff Schedule

To configure your season tariff schedule, select Energy/TOU from the Meter Setup menu, and then click on the TOU Calendar tab.


PM175 - Energy/TOU Setup
Energy/TOU Registers
TOU Daily Profiles
TOU Calendar
TOU Calendar
No. Season Day Type Week of Month Weekday Till Weekday Month Day Till Month Till Day
1 #1 #1 ---- Monday Friday ---- ---- ---- ----
2 #1 #2 ---- Saturday Sunday ---- ---- ---- ----
3 #1 #2 ---- ---- ---- January 1 ---- ----
4 #1 #2 Last Monday ---- May ---- ---- ----
5 #1 #2 ---- ---- ---- July 4 ---- ----
6 #1 #2 First Monday ---- September ---- ---- ----
7 #1 #2 Fourth Thursday ---- November ---- ---- ----
8 #1 #2 ---- ---- ---- December 25 ---- ----
9 ---- ---- ---- ---- ---- ---- ---- ----
10 ---- ---- ---- ---- ---- ---- ---- ----
11 ---- ---- ---- ---- ---- ---- ---- ----
12 ---- ---- ---- ---- ---- ---- ---- ----
13 ---- ---- ---- ---- ---- ---- ---- ----
14 ---- ---- ---- ---- ---- ---- ---- ----
15 ---- ---- ---- ---- ---- ---- ---- ----
16 ---- ---- ---- ---- ---- ---- ---- ----
Open
Save as...
Clear
Print
Send
Receive
OK
Cancel
Apply
Help

The meter's TOU calendar allows you to configure any tariff schedule based on any possible utility regulation. The calendar itself has 32 entries that allow you to specify profiles for working days and holidays through all seasons in any order that is convenient for you, based on simple intuitive rules. There are no limitations on how to define your schedule. The meter is able to automatically recognize your settings and to select a proper daily tariff schedule for any day within a year.

The above picture gives you an example of a single-season tariff schedule configured for weekends and the designated U.S.A. holidays.

To configure your season tariff schedule:

1. In the "Season" box, select the season, and in the "Day Type" box, select a day type for this calendar entry.

2. Select the time interval when this daily tariff schedule is effective, based on the start and the end weekdays and, for a multi-season schedule, on the start and the end month for the selected season. It does not matter which order of weekdays or months you select: the meter recognizes the correct order.
3. For exception days like designated holidays, select a specific day either by specifying a day and month, or by selecting a month, a week and a weekday within the month.

Configuring Recorders

The PM175 is provided with a 1-Megabyte onboard non-volatile memory for data, event and waveform recording.

Before using recorders, the device memory should be partitioned between log files. The device memory is fully configurable. You can define how much memory to allocate for each log file. If you want to change the factory settings, follow the guidelines in the section below.

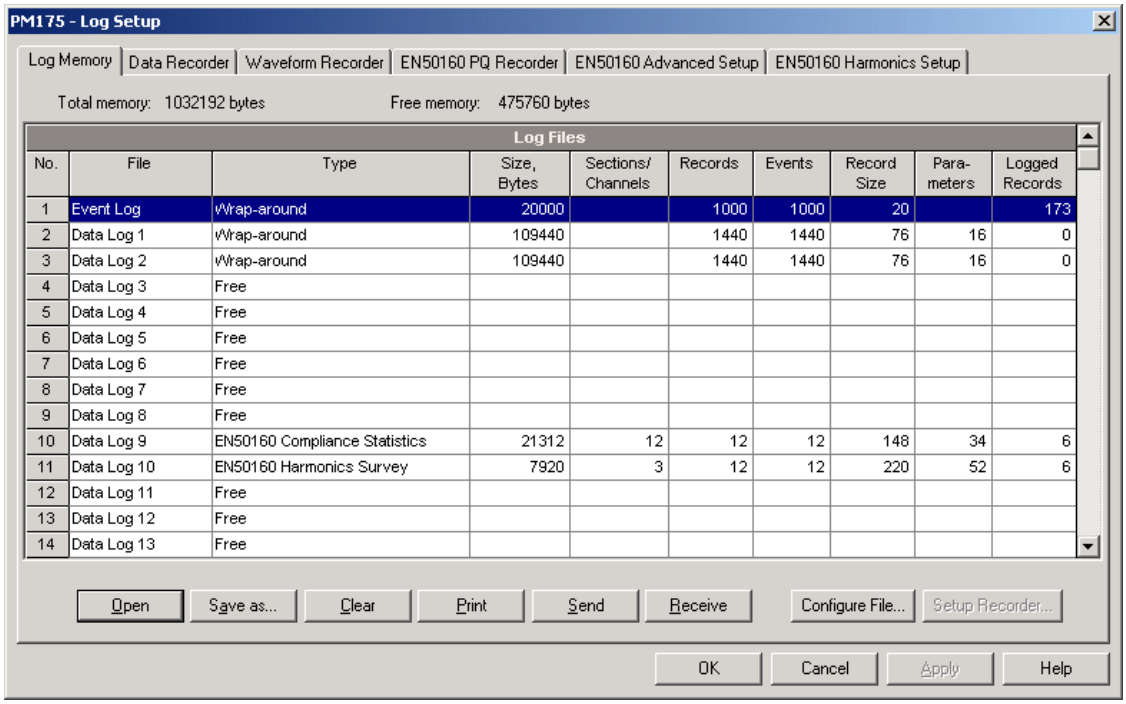
Configuring Device Memory

The device memory can be partitioned for a total of 20 log files:

- Event log
- 16 Data logs
- 2 Waveform logs
- EN50160 Power Quality log

Two of the data log files – Data log #9 and #10 – are automatically configured in your meter for recording EN51060 compliance statistics data and harmonics survey data. You cannot change the file records structure, but you can change the amount of memory that will be allocated for recording data.

To view the present device memory settings, select Memory/Log from the Meter Setup menu, and then click on the Log Memory tab.


PM175 - Log Setup
Log Memory
Data Recorder
Waveform Recorder
EN50160 PQ Recorder
EN50160 Advanced Setup
EN50160 Harmonics Setup
Total memory: 1032192 bytes
Free memory: 475760 bytes
Log Files
No. File Type Size, Bytes Sections/ Channels Records Events Record Size Para- meters Logged Records
1 Event Log Wrap-around 20000 1000 1000 20 173
2 Data Log 1 Wrap-around 109440 1440 1440 76 16 0
3 Data Log 2 Wrap-around 109440 1440 1440 76 16 0
4 Data Log 3 Free
5 Data Log 4 Free
6 Data Log 5 Free
7 Data Log 6 Free
8 Data Log 7 Free
9 Data Log 8 Free
10 Data Log 9 EN50160 Compliance Statistics 21312 12 12 12 148 34 6
11 Data Log 10 EN50160 Harmonics Survey 7920 3 12 12 220 52 6
12 Data Log 11 Free
13 Data Log 12 Free
14 Data Log 13 Free
Open
Save as...
Clear
Print
Send
Receive
Configure File...
Setup Recorder...
OK
Cancel
Apply
Help

The following table lists available file options.

Option	Range	Description
Type	Wrap-around Non-wrap TOU Daily Profile	Defines the file behavior when it is filled up. Wrap-around: recording continues over the oldest records. Non-wrap: recording is stopped until the file is cleared. TOU Daily profile: TOU daily profile data log (only for Data log #16).
Size		The memory size allocated to the file. Set automatically depending on the size of the records and the number of records in the file.
Sections/Channels	0-14	The numbers of sections in a multi-section TOU profile data log file, or the number of recording channels in a waveform log file

Option	Range	Description
Num. of Records	0-65535	Allocates the file memory for predefined number of records
Record size		The size of the file record for a single channel or a section. Set automatically depending on the file and on the number of parameters in the data record
Parameters	0-16	The number of parameters in a single data record (not including the EN50160 statistics files)

Memory is allocated for each file statically when you set up your files and will not change unless you re-organize the files. The meter automatically performs de-fragmentation of the memory each time you re-organize your files. This helps keep all free memory in one continuous block and thus prevents possible leakage of memory caused by fragmentation.

To change the file properties or to allocate the memory for a new file, double click on the file partition you want to change, select desired parameters for your log, and click OK. For your reference, the record size and the number of records available for your file are reported in the dialog box.

To delete an existing file partition, click on Delete and then click OK.

The following table shows how to calculate a file size for different log files.

File	Record Size, Bytes	File Size, Bytes
Event Log	20	Record size × Number of records
Data Log	12 + 4 × Number of parameters	Record size × Number of records
EN50160 Compliance Statistics, Data log #9	148 (per channel) × 12	Record size × Number of records
EN50160 Harmonics Survey, Data log #10	220 (per channel) × 3	Record size × Number of records
TOU Profile Log, Data log #16	12 + 4 × (Number of season tariffs + 1 if the TOU summary register is ordered)	Record size × Number of TOU registers x Number of records (× 2 if the maximum demand profile is also ordered)
Waveform Log	1068 (per channel)	Record size × Number of Channels x Number of series (events) × Number of records per series
EN50160 Power Quality Log	32	Record size × Number of records

For more information on configuring specific files, see “Configuring Data Log Files” and “Configuring Waveform Files” below.

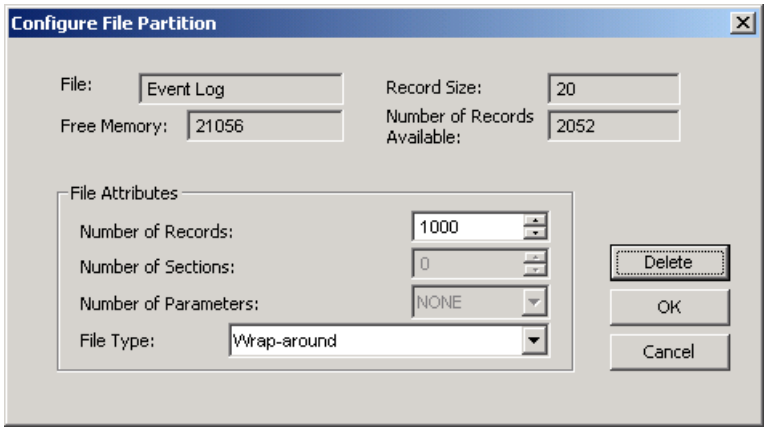
The memory is pre-configured for common data trending and fault recording applications as shown in the following table.

No.	File	Type	Size, Bytes	Channels	Number of Records	Number of Events	Description
1	Event log	Wrap around	20000		1000	1000	
2	Data log #1	Wrap around	109440		1440	1440	Configured for data trending
3	Data log #2	Wrap around	109440		1440	1440	Configured for data trending
10	Data log #9	Wrap around	21312	12	12	12	Configured for EN50160 compliance statistics
11	Data log #10	Wrap around	7920	3	12	12	Configured for EN50160 harmonics survey
18	Waveform log #1	Wrap around	256320	6	40	20	32 samples/cycle x 32 cycles/series
19	Waveform log #2	Wrap around	256320	6	40	20	128 samples/cycle x 8 cycles/series
27	EN50160 Power Quality log	Wrap around	32000		1000	1000	

Configuring the Event Recorder

To configure the Event log file:

1. Double click on the Event Log file partition with the left mouse button.



2. Select a partition type for your file.
3. Select the maximum number of records you want to be recorded in the file.
4. Click OK, then send your new setup to the meter or save to the device database.

By default, the Event recorder stores all events related to configuration changes, reset, and device diagnostics. In addition, it records events related to setpoint operations. Each setpoint should be individually enabled for recording to the Event log.

To log setpoint operations, add the “Event log” action to the setpoint actions list. When a setpoint event happens, the Event recorder logs all setpoint conditions that caused the event and all setpoint actions performed in response to the event. Logging actions themselves will not be recorded to the Event log.

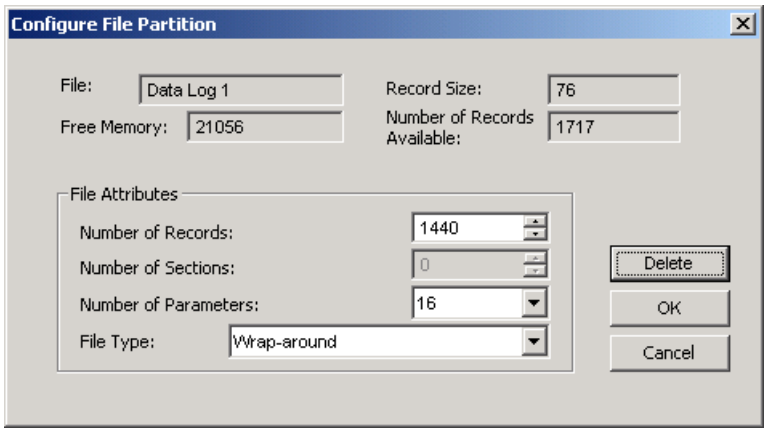
Configuring the Data Recorder

The Data recorder is programmable to record up to 16 data parameters per record in each of 16 data log files. The list of parameters to be recorded to a data log is configured individually for each file.

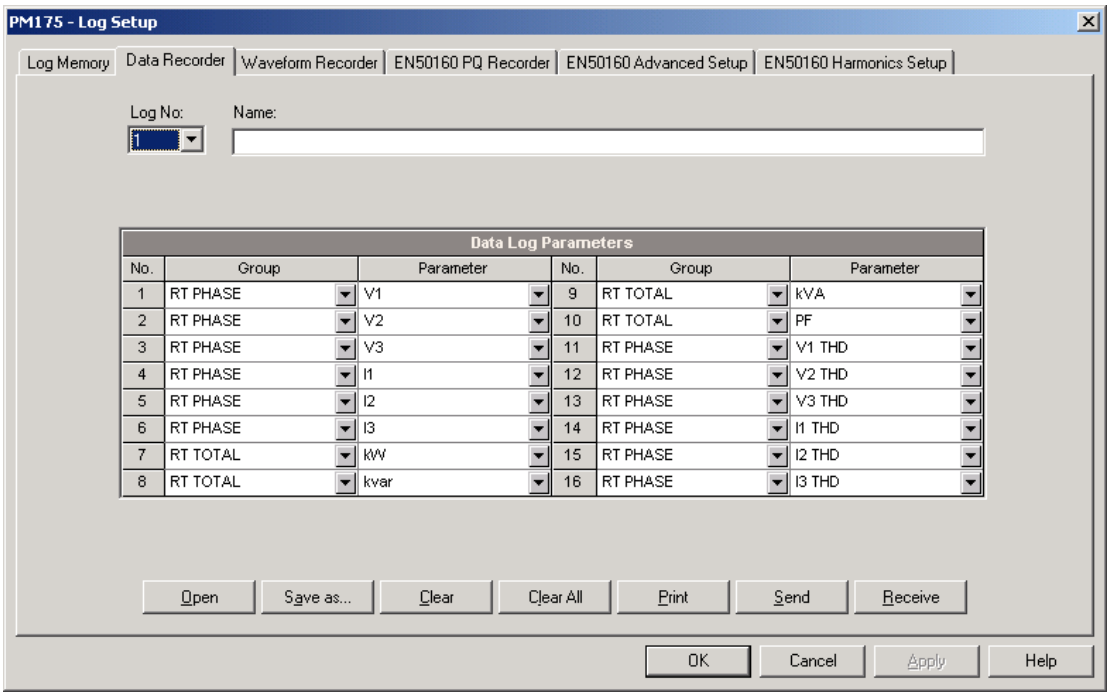
Conventional Data Log Files

To create a new data log file or re-configure an existing file:

1. Double click on the file partition with the left mouse button.



2. Select a partition type for your file.
3. Select the number of parameters you want to be recorded in the file records.
4. Select the maximum number of records you want to be recorded in the file.
5. Click OK, and then send your new setup to the meter, or save to the device database.
6. Highlight the data log file row with the left mouse button, and then click on the “Setup Recorder” button, or click on the “Data Recorder” tab and select the log number corresponding to your file.



7. Configure the list of parameters to be recorded in your data log file. You are not allowed to select more parameters than you defined when configuring your file. Refer to Appendix D for a list of available parameters.

   For your convenience, PAS will follow your selection and help you to configure a series of the neighboring parameters: when you open the “Group” box for the next parameter, PAS highlights the same group as in your previous selection; if you select this group again, PAS will automatically update the “Parameter” box with the following parameter in the group.

8. Add the name for your data log file in the “Name” box. It will appear in the data log reports.
9. Save your new setup to the device database, and send it to the meter.

Factory Preset Periodic Data Logs

Data logs #1 and #2 are factory preset for periodic recording of the standard power quantities as shown in the following table.

No.	Parameter	No.	Parameter
Data Log #1			
1	V1/V12	9	Total kVA
2	V2/V23	10	Total PF
3	V3/V31	11	V1/V12 THD
4	I1	12	V2/V23 THD
5	I2	13	V3/V31 THD
6	I3	14	I1 THD
7	Total kW	15	I2 THD
8	Total kvar	16	I3 THD
Data Log #2			
1	V1/V12 Demand	9	KVA Sliding Demand
2	V2/V23 Demand	10	kWh Import
3	V3/V31 Demand	11	kWh Export
4	I1 Demand	12	kvarh Import
5	I2 Demand	13	kvarh Export
6	I3 Demand	14	kVAh
7	kW Import Sliding Demand	15	In
8	kvar Import Sliding Demand	16	Frequency

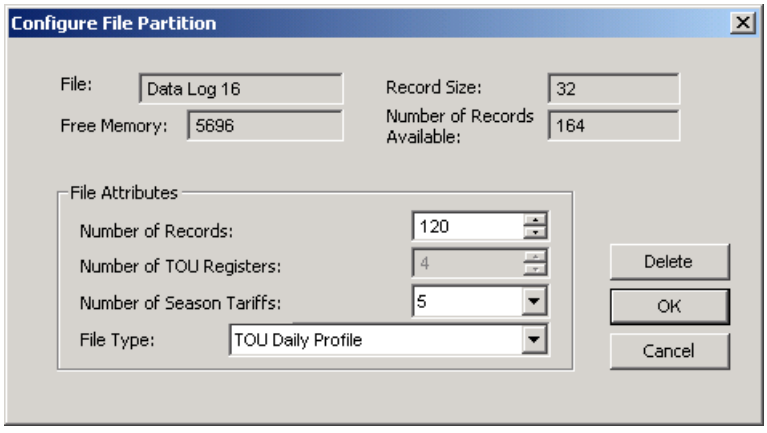
TOU Profile Data Log Files

Data log #16 is configurable to store TOU daily profile log records on a daily basis.

A TOU profile log file is organized as a multi-section file that has a separate section for each TOU energy and maximum demand register. The number of sections is taken automatically from the Summary/TOU Registers setup (see Setting up Total and Tariff Registers). If you selected to profile TOU maximum demands along with energy registers, then the number of sections in the file will be twice the number of the allocated TOU registers.

To configure a TOU daily profile log file:

1. Configure your TOU registers and TOU schedule in the meter before allocating memory for the profile log file (see Setting up Total and Tariff Registers).
2. Double click on the Data Log#16 partition with the left mouse button.



3. Select the TOU Daily Profile file type.

4. Select the number of season tariffs in your TOU schedule. Add one additional parameter if you selected to record the Summary (TOU total) registers as well.
5. Select the maximum number of records you want to be recorded in the file assuming that a new record will be added once a day.
6. Click OK and send your setup to the meter or save to the database.

Configuring the Waveform Recorder

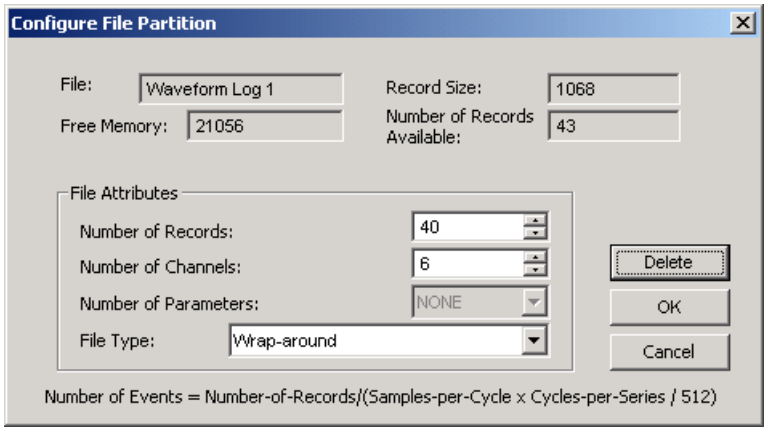
Waveform log files are organized as multi-section files that store data for each recording channel in a separate section. A waveform log file stores up to 6 channels simultaneously: three voltage and three current channels.

A single channel waveform record contains 512 points of the sampled input signal. If a waveform log is configured to record more samples per event than a single record can hold, the waveform recorder stores as many records per event as required to record the entire event. All waveform records related to the event are merged in a series and have the same series number, so they can be plotted together.

The PM175 supports two waveform files that record waveforms at three programmable sampling rates: 32, 64 or 128 samples per cycle.

To configure a waveform log file:

1. Double click on a waveform log partition with the left mouse button.



2. Select a partition type for your file.
3. Select the maximum number of records you want to be recorded in the file.

   The number of records in the waveform log file needed to store one waveform event (series) is defined as follows:

   Number of Records per Series = Sampling Rate (Samples per Cycle) x Number of Cycles per Event / 512

   The total number of records you must allocate to store the required number of events (series) is defined as follows:

   Number of Records = Number of Records per Series x Number of Series

   For example, if you want to record a 64-cycle waveform sampled at a rate of 32 samples per cycle, the number of records required for one waveform series would be:

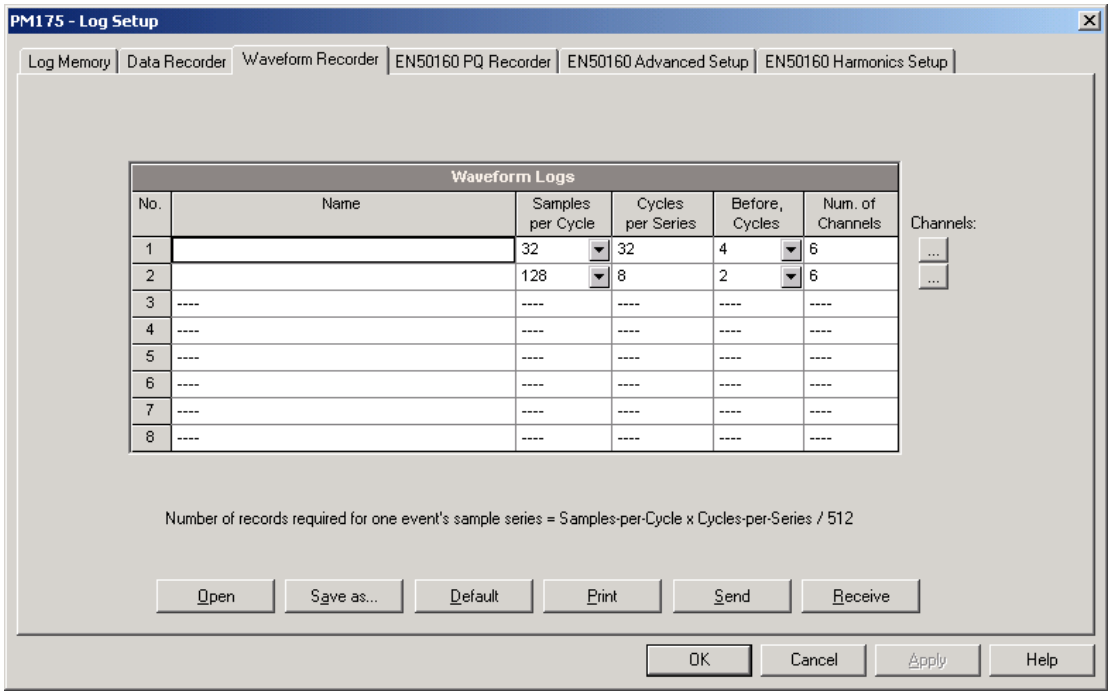
   Number of Records per Series = (32 x 64)/512 = 4.

   If you want to allocate space sufficient to store 20 waveform events (series), you should set up the waveform log file for 4 x 20 = 80 records.

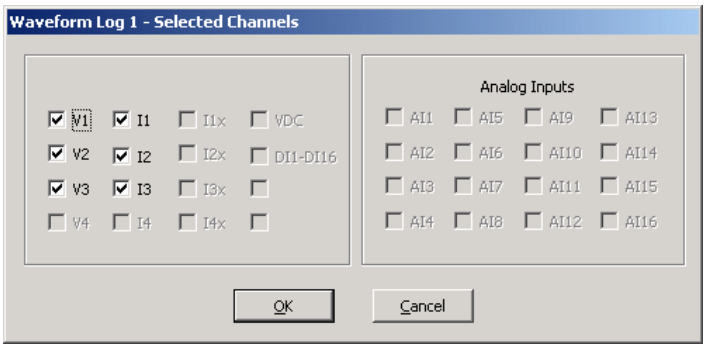
4. Click OK, and send your setup to the meter or save to the database.
5. Click “Setup Recorder”, or click on the “Waveform Recorder” tab.

The following table lists available waveform options.

Option	Format / Range	Description
Samples per Cycle	32, 64, 128	Waveform sampling rate
Cycles per Series	16-2560 (32 samples/cycle), 8-1280 (64 samples/cycle), 4-640 (128 samples/cycle)	Defines the total duration of the waveform per event/series
Before Cycles	1-20	Defines the number of cycles to be recorded prior to event
Num. of Channels	1-6	The number of the simultaneously recorded channels



6. Select the sampling rate for waveforms.
7. Select the number of cycles to be recorded prior to the event, and a total number of cycles in the waveform.
8. Add the name for your waveform log file in the “Name” box. It will appear in the waveform reports.
9. To select the AC channels, click on the Channels button, check the boxes for channels you want to be recorded, and then click OK.



10. Save your waveform setup to the device database, and send it to the meter.

EN50160 Evaluation and Recording

EN50160 Background

The EN50160 European standard “Voltage characteristics of electricity supplied by public distribution systems” issued by CENELEC defines the main physical characteristics of electric energy supplied by low and medium voltage public distribution systems under normal operating conditions.

The voltage characteristics are evaluated using a statistical approach. The standard and its referenced publications specify for each voltage characteristic:

- Method of evaluation
- Integrating interval for a single measurement
- Observation period
- Statistical indication of the probability of not exceeding a specified limit
- Standard compliance limits or indicative values within which any customer can expect the voltage characteristics to remain

Compliance Limits

For some voltage characteristics, the standard provides definite limits that can be complied with for most of the time considering the possibility of relatively rare excursions beyond these limits. Limits are set with a view to compliance for a percentage of the observation time, e.g. 95% of the observations in any period of one week.

The following table gives the characteristics for which definite limits have been specified by the standard.

Voltage characteristic	Compliance with stated limits, % of time	Observation period
Power frequency	±1% for 95% of a week ±1% for 99.5% of a year +4/-6% for 100% of time	Week, year
Voltage variations (supply voltage magnitude)	±10% Un for 95% of time	Week
Rapid voltage changes	≤4-5% Un (up to 10% Un)	Day
Flicker (fluctuations of voltage magnitude)	Plt ≤ 1 for 95% of time	Week
Voltage unbalance	≤2-3% for 95% of time	Week
Harmonic voltage	THD ≤ 8 for 95% of time	Week
Interharmonic voltage	To be defined	Week
Mains signaling voltage	Within “Meister-curve” for 99% of time	Day

Indicatives Values

For the remaining characteristics of the voltage, by their unpredictable nature, the standard gives only indicative values, which are intended to provide users with information on the order of magnitude which can be expected.

The following table gives the characteristics for which indicative values have been specified by the standard.

Voltage Characteristic	Indicative values	Observation period
Voltage dips	Less than 1 s, 60% depth	Year
Short interruptions	70% less than 1 s	Year
Long interruptions	10 to 50% less than 3 min	Year
Temporary overvoltages	Less than 1.5 kV RMS	Year
Transient overvoltages	Less than 6 kV peak	Year

Resources

CENELEC publications:

EN 50160:1999 Voltage characteristics of electricity supplied by public distribution systems

IEC publications:

IEC 61000-4-7:2002 Electromagnetic compatibility (EMC) – Part 4-7 Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto,

IEC 61000-4-15:2003 Electromagnetic compatibility (EMC) – Part 4 Testing and measurement techniques – Section 15: Flickermeter – Functional and design specifications

IEC 61000-4-30:2003 Electromagnetic compatibility (EMC) – Part 4-30 Testing and measurement techniques – Power quality measurement methods

Eurelectric (Union of the Electricity Industry) publications:

Application guide to the European Standard EN 50160 on Voltage characteristics of electricity supplied by public distribution systems, Ref: 23002 Ren9530, July 1995

Measurement guide for voltage characteristics, Ref: 23002 Ren9531, July 1995

Evaluation Techniques

EN50160 Evaluation Counters

Evaluation Counters and Evaluation Period

The PM175 uses a set of the evaluation counters for collecting EN50160 statistics within a specified evaluation period.

The evaluation period is the period of time within which the meter collects statistical evaluation data. Supply voltage characteristics can be evaluated on a weekly or daily basis. The evaluation period being normally preset in your meter to a week can be changed via the EN50160 Advanced setup.

At the end of the evaluation period, the meter records collected statistical evaluation data to a log file, and then clears the evaluation registers and counters so that each evaluation period's statistics is stored in a separate record.

You can upload and view the online statistics data via PAS reports, using data collected since the beginning of the present evaluation interval. You can also manually clear the present contents of the counters though PAS before starting your EN50160 evaluation.

Observation Period

The observation period is the period of time within which the voltage characteristics shall be assessed to ensure compliance with the standard. The observation periods declared by the EN50160 may differ for characteristics for which compliance limits are specified in the standard, usually one week, and for those for which only indicative values are provided, usually one year.

The EN50160 compliance reports produced by PAS provide correct weekly and yearly observation statistics regardless of the evaluation periods used for collecting data. Whenever needed, PAS will aggregate records within a number of the evaluation intervals to provide correct observation periods. Some of the characteristics, like rapid voltage changes or mains signaling voltage, may require daily assessments. If you intend to use daily-evaluated voltage characteristics, select the daily evaluation period via the EN50160 Advanced setup.

EN50160 Compliance Statistics Log

Data log file #9 is automatically configured in the PM175 for recording EN50160 compliance statistics. Appendix E lists parameters recorded to the file. The file is arranged as a multi-section data log file where each voltage characteristic statistics is stored in a separate section. Along with EN50160 compliance statistics recorded at the end of each evaluation period, file also contains data that may be useful for trouble-shooting power quality problems for non-compliant voltage characteristics.

You can upload and view the EN50160 compliance statistics data via PAS reports or via common PAS data logs views.

EN50160 Harmonics Survey Log

Data log file #10 is automatically configured in the PM175 for recording harmonics survey statistics on a weekly or daily basis. You can see parameters recorded to the file in Appendix E. The file stores maximum THD (total, odd and even harmonics) and maximum harmonic voltages up to order 50 collected within each evaluation period.

Harmonics survey is normally intended for trouble-shooting harmonic problems throughout electrical networks. It can be separately disabled or enabled in your meter via the EN50160 Advanced Setup. The evaluation period for harmonics survey can be selected independently from the EN50160 compliance evaluation.

You can upload and view the harmonics survey data collected by your device via PAS reports or via common PAS data logs views.

EN50160 Power Quality Event Log

The PM175 provides the EN50160 Power Quality (PQ) recorder that can detect EN50160 incidents and record each individual power quality event to the log file with the start and end timestamps and a fault magnitude. It may be useful for trouble-shooting problems throughout the electrical network, for example, to identify and locate the source of a power quality event and to select an appropriate solution.

The EN50160 power quality report can be uploaded and viewed via PAS (see Viewing EN50160 Power Quality Event Log). Transient overvoltages and short-duration voltage dips and temporary overvoltages recorded to the file can also be viewed in PAS as magnitude/duration pairs on the well-known ITIC curve chart for assessing the minimum equipment immunity.

The PQ recorder is programmable to trigger the waveform recorder to record the fault waveforms before, during and after the PQ event for detailed event analysis.

Methods of Evaluation

This section describes methods used by the PM175 for evaluating supply voltage characteristics to ensure compliance with the standard.

Frequency Variations

Method of Evaluation

The basic frequency measurement is the mean value of the frequency over fixed time intervals of 10 seconds under normal operating conditions.

A frequency variation is not evaluated if the supply voltage crosses a voltage tolerance limit (±15% Un).

Target Values

The ranges of frequency variations given in the EN50160 are:

50Hz±1% for 95% of a week

50Hz±1% for 99.5% of a year

50Hz+4/-6% for 100% of the time

The same limits are used for 60Hz systems. The frequency compliance limit can be programmed in the meter in percent of the nominal power frequency via the EN50160 PQ Recorder setup.

Supply Voltage Variations

This characteristic defines slow variations of steady state supply voltage magnitude.

Method of Evaluation

The basic supply voltage magnitude measurement is the RMS value of the steady state voltage over a period of 10 minutes under normal operating conditions.

A voltage variation is not evaluated if the supply voltage crosses a voltage tolerance limit (±15% Un).

Target Values

The range of voltage variations given in the EN50160 is:

±10% Un for 95% of a week

The supply voltage compliance limit can be changed in the meter via the EN50160 PQ Recorder setup.

Rapid Voltage Changes

Rapid voltage changes are sudden but relatively weak voltage variations between two steady state voltage levels.

Method of Evaluation

Evaluation of rapid voltage changes is made on an hourly basis. The RMS voltage is evaluated over 3-second time integration intervals. The meter establishes the maximum difference of the RMS voltage between two intervals selected from three 3-second consecutive intervals and compares it with the target compliance limit.

A rapid voltage change is not classified if it crosses a voltage tolerance limit (±10% Un), as it would be considered a voltage dip or a temporary overvoltage.

Target Values

The maximum rate of rapid voltage changes in normally once per hour or less. For voltage variations repeating more than once an hour, amplitude is limited by the flicker index. The maximum rate of rapid voltage changes in variations per hour can be changed in the meter via the EN50160 Advanced Setup. The target magnitude limit of rapid voltage changes can be programmed in the meter via the EN50160 PQ Recorder setup.

Under usual operating conditions the magnitude of rapid voltage changes (once per hour or less) should generally not exceed 5% of nominal voltage in LV networks, and 4% in MV networks. In some circumstances, like in systems where equipment switching must be carried out to meet supply system or load requirements, it can reach 10%Un in LV networks, and 6%Un in MV networks.

Flicker

Flicker expresses the visual discomfort caused by repetitive changes of brightness in lightning subjected to fluctuations of the supply voltage. Flicker is indicated by the long-term flicker severity parameter Plt, which is evaluated every 2 hours.

Method of Evaluation

The basic measurement is the short-term flicker severity indicator Pst, evaluated each 10 minutes by instrumentation complying with IEC 61000-4-15. The indicative long-term flicker severity Plt is evaluated from 12 consecutive Pst values. For testing purposes, the Pst period can be temporarily changed in the meter in the range of 1 to 10 minutes via the EN50160 Advanced Setup.

Pst values are not classified during intervals when the supply voltage magnitude exceeds a voltage tolerance limit (±15% Un) or is affected by voltage dips with depth more than 15% Un.

Target Values

The flicker compliance limit given in the EN50160 is:

Plt ≤ 1 for 95% of a week

The Plt compliance limit can be changed in the meter via the EN50160 PQ Recorder setup.

Voltage Dips

A voltage dip is a sudden reduction of the RMS voltage below 90% of the nominal value, followed by a return to a value higher than 90% of the nominal in a time varying from 10 ms to 60 s.

Method of Evaluation

A voltage dip is classified as one polyphase event regardless of the shape and of the number of phases affected (as per Eurelectric's Application guide to the European Standard EN 50160, and IEC 61000-4-30). An event can begin on one phase and end on another phase. The fault magnitude is recorded separately for each phase involved. The event duration is measured from the instant at which the voltage falls below the start threshold on one of the phases to that at which it becomes greater than the end threshold on all affected phases including a threshold hysteresis.

The basic voltage dip measurement is one-cycle RMS voltage updated each half-cycle.

The voltage dip threshold can be changed in the meter via the EN50160 PQ Recorder setup.

Statistical Results

The PM175 provides the statistical evaluation of voltage dips using the classification established by UNIPEDE. Dips are classified by residual voltage magnitude and duration as shown in Appendix E.

Indicative Values

Under normal operating conditions the expected number of voltage dips in a year may be from up to a few tens to up to one thousand. The majority of voltage dips have a duration less than 1 s and a depth less than 60%.

Voltage Interruptions

Voltage interruptions correspond to temporary loss of supply voltage on all phases lasting less than or equal to 3 minutes in the event of short interruptions, and more than 3 minutes for long interruptions.

Method of Evaluation

The voltage interruption is detected when the voltages on all phases fall below the interruption threshold (as per IEC 61000-4-30) specified by the EN50160 at a level of 1%Un. The interruption threshold can be changed in the meter via the EN50160 PQ Recorder setup.

The basic voltage measurement is one-cycle RMS voltage updated each half-cycle.

Statistical Survey

The PM175 provides the statistical evaluation of voltage interruptions using the classification recommended by Eurelectric's Measurement guide for voltage characteristics.

Interruptions are classified by duration as shown in Appendix E.

Indicative Values

Under normal operating conditions the expected number of short voltage interruptions in a year may be from up to a few tens to up to several hundreds. Short interruptions generally last less than a few seconds.

The annual frequency of long interruptions may be less than 10 or up to 50 depending on the area.

Temporary Overvoltages

Temporary overvoltages are sudden rises of the voltage RMS value of more than 110% of nominal voltage. Temporary overvoltages may last between 10 milliseconds and one minute.

Method of Evaluation

A temporary overvoltage is classified as one polyphase event regardless of the shape and of the number of phases affected (as per IEC 61000-4-30). An event can begin on one phase and end on another phase. The fault magnitude is recorded separately for each phase involved. The event duration is measured from the instant at which the voltage rises above the start threshold on one of the phases to that at which it becomes lower than the end threshold on all affected phases including a threshold hysteresis.

The overvoltage threshold can be changed in the meter via the EN50160 PQ Recorder setup.

The basic voltage measurement is one-cycle RMS voltage updated each half-cycle.

Statistical Survey

The PM175 provides the statistical evaluation of temporary overvoltages using the classification recommended by Eurelectric's Measurement guide for voltage characteristics. Temporary overvoltages are classified by voltage magnitude and duration as shown in Appendix E.

Indicative Values

Temporary overvoltages on the low voltage side will generally not exceed 1.5 kV RMS.

Transient Overvoltages

Transient overvoltages correspond to disturbances of very short duration, lasting typically less than one half-cycle, i.e. a few microseconds to several milliseconds.

Method of Evaluation

Transient overvoltages are detected as impulsive transients with a rise time less than 0.5 ms and duration from 150 us to ½ cycle. The impulse magnitude is evaluated by the peak voltage value and is referenced to the nominal peak voltage (1.414 Un). The meter can detect transient overvoltages with a magnitude of up to 700V.

Statistical Survey

The PM175 provides the statistical evaluation of transient overvoltages using the classification recommended by Eurelectric's Measurement guide for voltage characteristics. Transient overvoltages are classified by voltage magnitude as shown in Appendix E.

Indicative Values

Temporary overvoltages in LV systems will generally not exceed 6 kV peak, but higher values occur occasionally.

Voltage Unbalance

This characteristic defines the magnitude and/or phase asymmetries of three-phase steady state supply voltage.

Method of Evaluation

The basic measurement is the RMS value of the steady state voltage unbalance over a period of 10 minutes under normal operating conditions. It is defined using the theory of symmetrical components by the negative sequence component expressed in percent of the positive sequence component.

Voltage unbalance is not evaluated if the supply voltage crosses a voltage tolerance limit (±15% Un).

Target Values

The range of voltage unbalance given in the EN50160 is:

≤ 2% (≤ 3% in some areas) for 95% of a week

The voltage unbalance compliance limit can be changed in the meter via the EN50160 PQ Recorder setup.

Harmonic Voltage

Method of Evaluation

The basic measurements are the individual harmonic voltage distortion factors (HD) and the total harmonic distortion factor (THD) over a period of 10 minutes under normal operating conditions.

Harmonic voltages are evaluated by instrumentation complying with IEC 61000-4-7. All calculations are made relative to the nominal voltage.

The THD is evaluated including all harmonics up to the order 40. Harmonic voltages are evaluated up the order 25 since the EN50160 provides target values for individual harmonic voltages only for orders up to 25. The highest harmonic order for evaluating individual harmonic voltages and THD can be changed in the meter in the range of 25 to 50 via the EN50160 Advanced Setup.

Harmonic voltages are not evaluated if the supply voltage crosses a voltage tolerance limit (±15% Un).

Target Values

The ranges of harmonic voltages given in the EN50160 are:

THD ≤ 8% for 95% of a week

Individual harmonic voltages shall be less than or equal to the values given in Table 1 in Clause 2.11 of the EN50160 for 95% of a week.

The THD compliance limit can be changed in the meter via the EN50160 PQ Recorder setup. The individual harmonic voltage limits can be adjusted via the EN50160 Harmonics setup.

Interharmonic Voltage

Method of Evaluation

Since the EN50160 does not specify target limits for interharmonic voltages, this feature is normally disabled in your meter. You can enable evaluation of interharmonic voltages via the EN50160 Advanced Setup.

The basic measurements are the individual interharmonic voltage distortion factors (HD) and the total interharmonic distortion factor (THD) over a period of 10 minutes under normal operating conditions.

Interharmonic voltages are evaluated by instrumentation complying with IEC 61000-4-7. All calculations are made relative to the nominal voltage.

The highest harmonic order for evaluating individual interharmonic voltages and interharmonic THD can be selected in the meter in the range of 25 to 50 via the EN50160 Advanced setup.

Interharmonic voltages are not evaluated if the supply voltage crosses a voltage tolerance limit (±15% Un).

Target Values

The EN50160 does not provide target limits for interharmonic voltages. The ranges of interharmonic voltages selected in the PM175 are:

Interharmonic THD ≤ 2% for 95% of a week

Individual interharmonic voltages shall be less than or equal to the values given in the following table for 95% of a week.

Interharmonic order	Relative Voltage
2	0.2
3-15	1.0
16-25	0.5

You can change the compliance limit for the interharmonic THD via the EN50160 PQ Recorder setup. The individual interharmonic voltage limits can be changed via the EN50160 Harmonics setup.

Mains Signaling Voltage

This characteristic defines the magnitude of the signal voltages used in some countries for signal transmission over public supply networks. These may include ripple control signals in a frequency range from 100 HZ to 3 kHz, and carrier wave communications signals in a frequency range from 3 kHz to 148.5 kHz.

The PM175 can evaluate ripple control signaling voltages in a frequency range from 100 Hz to 3 kHz.

Method of Evaluation

Since evaluating signal voltages is not commonly used, this feature is normally disabled in your meter. You can enable evaluation of signaling voltages via the EN50160 Advanced Setup.

The PM175 evaluates up to four ripple control frequencies. You can select the required signaling frequencies via the EN50160 Advanced Setup.

The basic measurement is the magnitude of the signaling voltage over a period of 3 seconds under normal operating conditions.

Signaling voltages are not evaluated if the supply voltage crosses a voltage tolerance limit (±15% Un).

Target Values

The voltage levels given by the EN50160 in Figure 1 of Clause 2.13 are taken from the so-called “Meister-curve” which defines the maximum permissible ripple control voltages in LV networks.

Compliance with the EN50160 requires that the 3-second mean of signal voltages shall be less or equal to the specified limits for 99% of a day.

Configuring the EN50160 Recorders

Basic Device Settings

The following device settings affect the EN50160 evaluation and should be checked prior to running the EN50160 recorders.

Reference Voltage

As the general approach of the EN50160, all voltage characteristics are referenced to the nominal voltage that shall be specified in your meter before running the EN50160 recorders (see Basic Meter Setup). The nominal voltage refers to the line-to-neutral supply voltage in LV networks (4LN3, 3LN3 or 3BLN3 wiring modes), and to line-to-line voltage in MV networks (4LL3, 3LL3, 3BLN3, 3OP2, 3OP3 and 3DIR2 wiring modes).

Reference Frequency

The nominal line frequency is used as a reference for the evaluation of power frequency variations. It should be specified in your meter before running the EN50160 recorders (see Basic Meter Setup).

EN50160 Evaluation Limits and Options

Limits for evaluation of the EN50160 voltage characteristics can be set via the EN50160 PQ Recorder Setup and, for harmonic and interharmonic voltages, via the EN50160 Harmonics Setup (see EN50160 Harmonics Limits Setup).

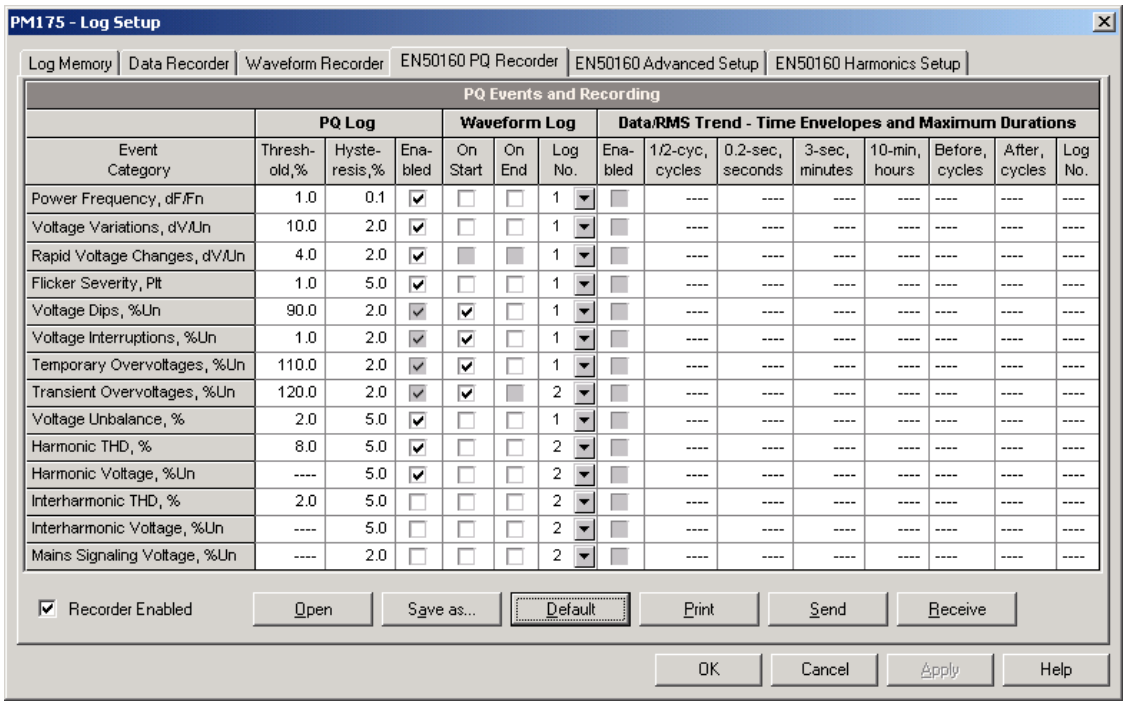
The EN50160 evaluation options can be changed via the EN50160 Advanced Setup.

EN50160 Logging Options

The memory allocated in your meter for the EN50160 compliance statistics and harmonics survey data is sufficient for 3-month data recording on a weekly basis. The Power Quality event log file is configured for 1000 event records. You can increase or change the size of the EN50160 data log files in your meter via the Log Memory Setup (see Configuring Device Memory).

EN50160 PQ Recorder Setup

The PQ recorder setup allows you to adjust the EN50160 evaluation limits (thresholds) for the specific voltage characteristics in the case the customer requirements differ from the values provided by the EN50160, and to select the event and waveform log options for the PQ event log.



To configure the PQ recorder:

1. Select Memory/Log from the Meter Setup menu, and then click on the EN50160 PQ Recorder tab.
2. Adjust thresholds and hysteresis for PQ triggers if required. The harmonic and interharmonic voltage limits can be individually set for each harmonic order via the EN50160 Harmonics Setup. Limits for the signaling voltage frequencies are automatically taken from the "Meister-curve".
3. Check the Enabled box for the voltage characteristics you want to be recorded to the PQ event log. You can individually enable or disable recording PQ events related to specific characteristics. Notice that the interharmonic voltage and mains signaling voltage evaluation should be also enabled in the meter via the EN50160 Advanced Setup.

   Disabling recording events to the PQ log does not prevent the evaluation of the voltage characteristics and collecting the EN50160 statistics for these events.
4. Select the waveform logging options for PQ events.
5. Download your setup to the device.

The picture above shows the default PQ recorder settings. The available options are listed in the following table.

Option	Range	Default	Description
PQ Log			
Threshold, %	0-200.0%		Defines the operating threshold for the PQ trigger in percent of the nominal (reference) value
Hysteresis, %	0-50.0%	5.0	Defines the hysteresis for the PQ trigger in percent of the threshold
Enabled	Checked Unchecked		Enables recording PQ events for specific voltage characteristics
Waveform Log			
On Start	Checked Unchecked	Checked	Enables waveform log when the PQ event starts
On End	Checked Unchecked	Unchecked	Enables waveform log when the PQ event ends
Log No.	1-2		Specifies the waveform log file used for waveform recording on the PQ event

The waveform log options allow recording waveforms both at the start and the end of a PQ event. Since the voltage variations can last from some seconds to minutes, this allows capturing and analyzing the voltage transitions using short time waveform recording at the start and at the end of the voltage sag or swell.

You can temporary disable the PQ recorder in your device. To enable or disable the PQ recorder:

1. Check or uncheck the Recorder Enabled checkbox.
2. Send your setting to the device.

Note that disabling the PQ recorder in your meter does not affect the evaluation and recording of the EN50160 statistics.

Indication of the Power Quality Events

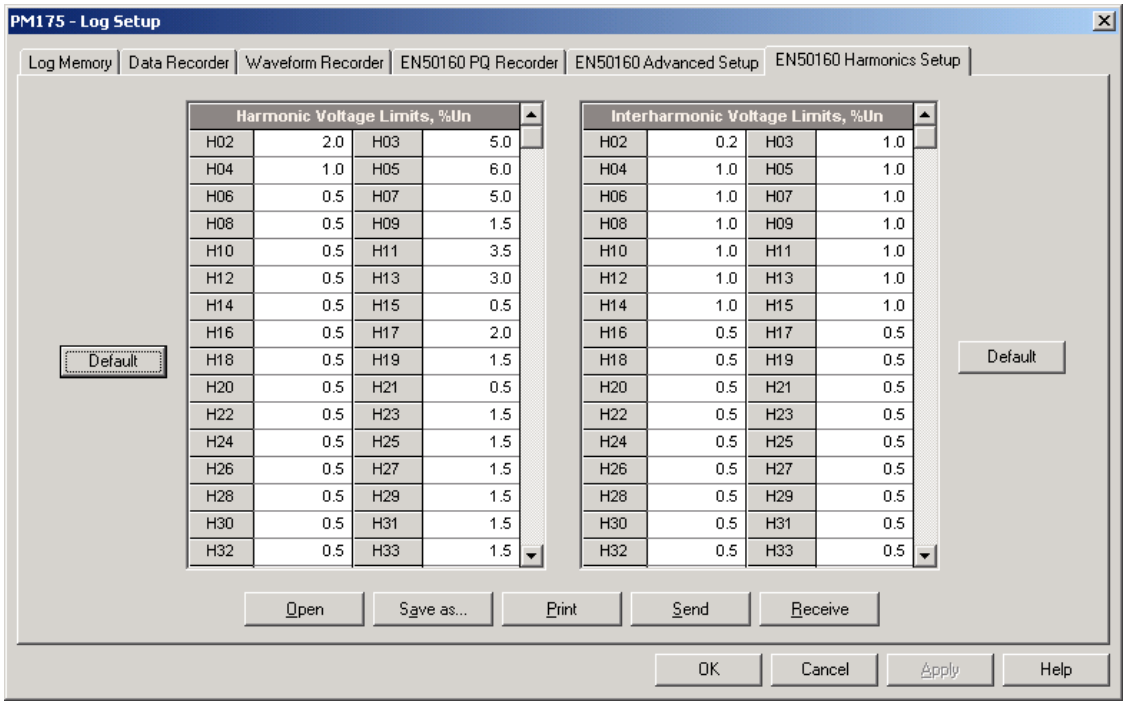
When the PQ recorder detects a power quality fault, it generates the specific internal event "PQ EVENT" that can be monitored through a control setpoint. The event is asserted all the time while the fault condition exists. The "PQ EVENT" trigger is used to give a power quality fault indication via relay contacts, or can be combined using the AND operator with timer ticks for periodic data recording at the time of the fault to produce voltage trending charts.

EN50160 Harmonics Limits Setup

This setup allows you to adjust compliance limits for harmonic and interharmonic voltages.

To change the default limits in your device:

1. Select Memory/Log from the Meter Setup menu, and then click on the EN50160 Harmonics Setup tab.



Harmonic Voltage Limits, %Un				Interharmonic Voltage Limits, %Un			
H02	2.0	H03	5.0	H02	0.2	H03	1.0
H04	1.0	H05	6.0	H04	1.0	H05	1.0
H06	0.5	H07	5.0	H06	1.0	H07	1.0
H08	0.5	H09	1.5	H08	1.0	H09	1.0
H10	0.5	H11	3.5	H10	1.0	H11	1.0
H12	0.5	H13	3.0	H12	1.0	H13	1.0
H14	0.5	H15	0.5	H14	1.0	H15	1.0
H16	0.5	H17	2.0	H16	0.5	H17	0.5
H18	0.5	H19	1.5	H18	0.5	H19	0.5
H20	0.5	H21	0.5	H20	0.5	H21	0.5
H22	0.5	H23	1.5	H22	0.5	H23	0.5
H24	0.5	H25	1.5	H24	0.5	H25	0.5
H26	0.5	H27	1.5	H26	0.5	H27	0.5
H28	0.5	H29	1.5	H28	0.5	H29	0.5
H30	0.5	H31	1.5	H30	0.5	H31	0.5
H32	0.5	H33	1.5	H32	0.5	H33	0.5

2. Adjust limits you want to change.
3. Download your setup to the device.

The default EM50160 compliance limits are shown in the picture above. You can change the number of the evaluated harmonics and interharmonics via the EN50160 Advanced Setup.

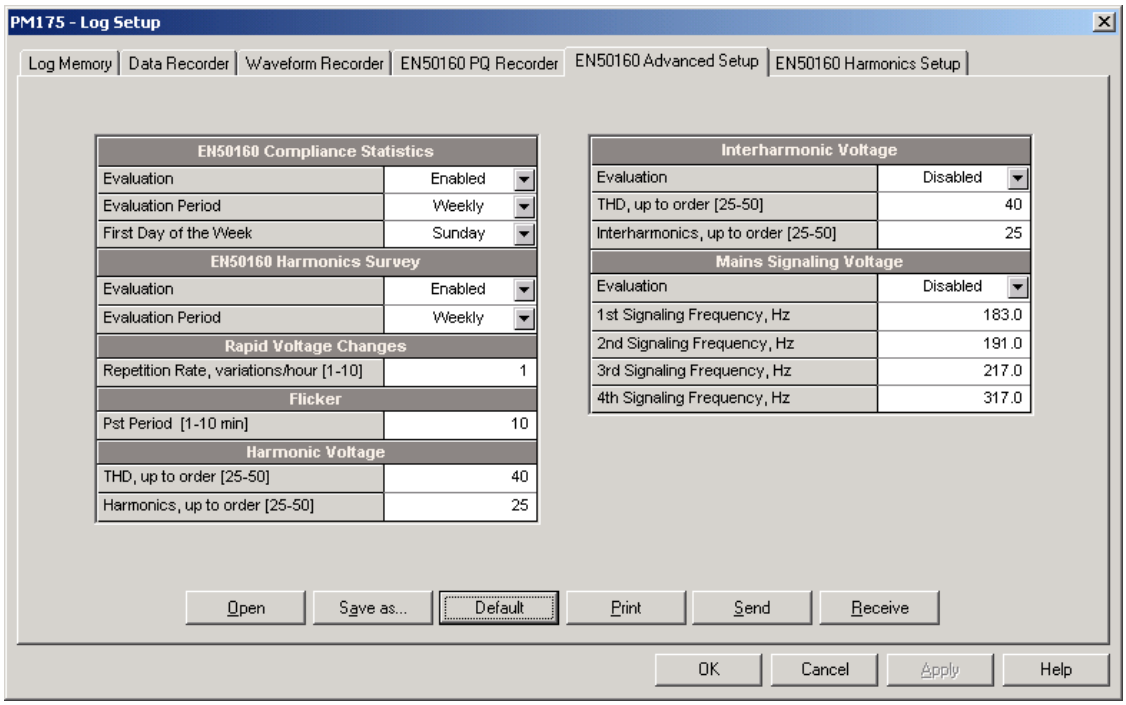
EN50160 Advanced Setup

The EN50160 Advanced Setup allows you to configure the EN50160 evaluation options in your meter.

To configure the EN50160 evaluation options:

1. Select Memory/Log from the Meter Setup menu, and then click on the EN50160 Advanced Setup tab.
2. Change the EN50160 evaluation options if required.
3. Download your setup to the device.

The default EN50160 evaluation options set in your device are shown in the picture below.



The available options are listed in the following table.

Option	Range	Default	Description
EN50160 Compliance Statistics			
Evaluation	Disabled, Enabled	Enabled	Enables the EN50160 evaluation
Evaluation Period	Daily, Weekly	Weekly	Defines the EN50160 statistics evaluation period
First Day of the Week	Sunday-Saturday	Sunday	Defines the first day of the week for statistics evaluated on a weekly basis
EN50160 Harmonics Survey			
Evaluation	Disabled, Enabled	Enabled	Enables the harmonics survey log
Evaluation Period	Daily, Weekly	Weekly	Defines the harmonics survey evaluation period
Rapid Voltage Changes			
Repetition Rate	1-10	1	Defines the maximum repetition rate in variations per hour (equal or less than) for rapid voltage changes. Voltage changes at higher rates are not classified since they will be subject for flicker.
Flicker			
Pst Period	1-10 min	10 min	Defines the period of time for the short-term flicker evaluation. The standard setting of 10 minutes can be temporarily changed in the device for testing purposes.
Harmonic Voltage			
THD, up to order	25-50	40	Defines the highest harmonic order included in the THD evaluation.
Harmonics, up to order	25-50	25	Defines the highest harmonic order for evaluation of the harmonic voltages.
Interharmonic Voltage			
Evaluation	Disabled, Enabled	Disabled	Enables the evaluation of the interharmonic voltages
THD, up to order	25-50	40	Defines the highest interharmonic order included in the THD evaluation.
Interharmonics, up to order	25-50	25	Defines the highest harmonic order for evaluation of the interharmonic voltages.

Option	Range	Default	Description
Mains Signaling Voltage			
Evaluation	Disabled, Enabled	Disabled	Enables the evaluation of the mains signaling voltages
1st Signaling Frequency	110-3000 Hz	183.0 Hz	Specifies the mains signaling frequency for the compliance evaluation
2nd Signaling Frequency	110-3000 Hz	191.0 Hz	Specifies the mains signaling frequency for the compliance evaluation
3rd Signaling Frequency	110-3000 Hz	217.0 Hz	Specifies the mains signaling frequency for the compliance evaluation
4th Signaling Frequency	110-3000 Hz	317.0 Hz	Specifies the mains signaling frequency for the compliance evaluation

Clearing EN50160 Evaluation Counters

To clear the present contents of the EN50160 evaluation counters before starting your EN50160 evaluation, check the On-line button, select Reset from the Monitor menu, and then Click on the “Clear EN50160 Counters” button (for more information, see Resetting Accumulators and Clearing Log Files).

Remote Device Control

This section describes online operations on the meter you can perform through PAS. To access device control options you should have your device online.

Remote Relay Control

PAS allows you to send a command to any relay in your device or release a latched relay, except of the relays that are linked to an internal pulse source. These relays cannot be operated outside of the device.

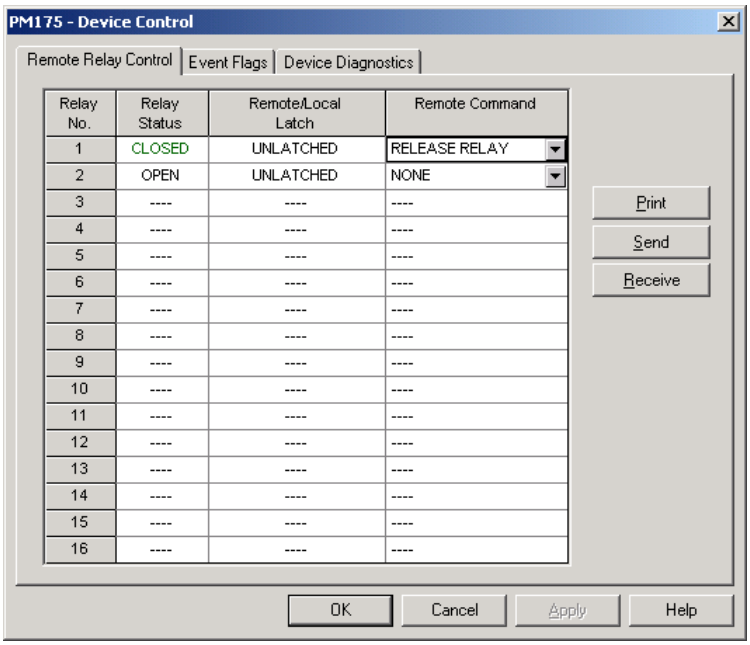
To enter the Remote Relay Control dialog, check the On-line button on the PAS toolbar, select Device Control from the Monitor menu, and then click on the Remote Relay Control tab.

To send a remote command to the relay:

1. From the “Relay Command” box for the relay, select the desired command:

   OPERATE – to operate a relay

   RELEASE - to remove your remote command, or to release a latched relay
2. Click on Send.



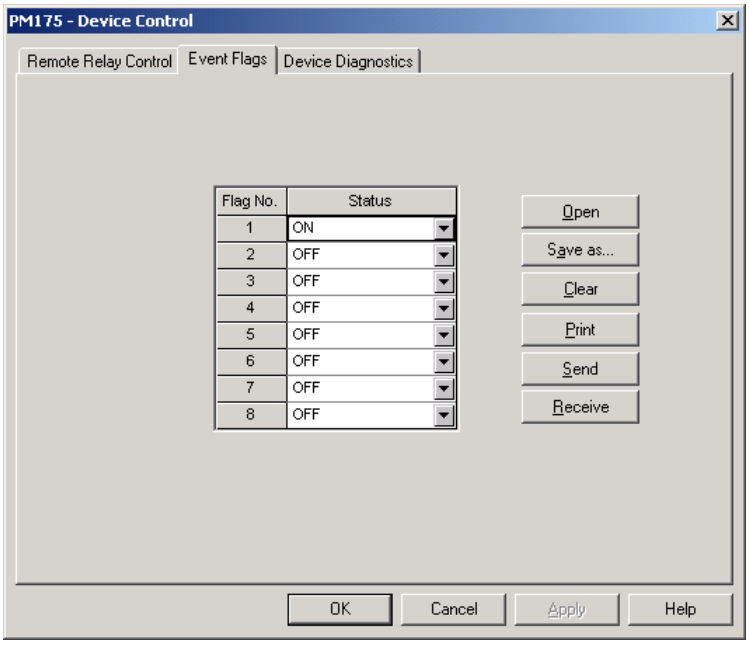
Event Flags

The PM175 provides 8 common event flags that are intended for use as temporary event storage and can be tested and operated from the control setpoints. You can transfer an event to the setpoint and trigger its operation remotely by changing the event status through PAS.

To enter the Event Flags dialog, check the On-line button on the PAS toolbar, select Device Control from the Monitor menu, and then click on the Event Flags tab.

To change the status of an event flag:

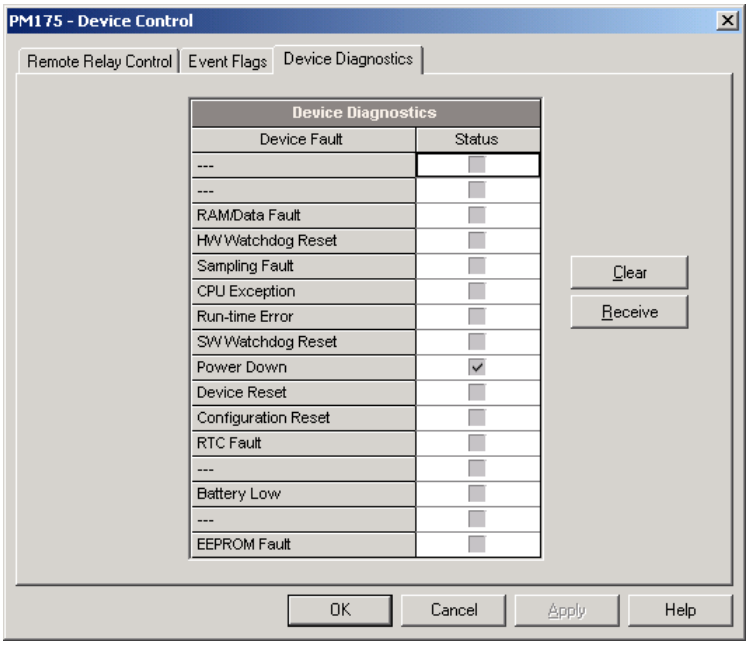
1. From the “Status” box, select the desired flag status.
2. Click on Send.



Device Diagnostics

PAS allows you to examine and clear the present device diagnostics status.

To enter the Device Diagnostics dialog, check the On-line button on the PAS toolbar, select Device Control from the Monitor menu, and then click on the Device Diagnostics tab.

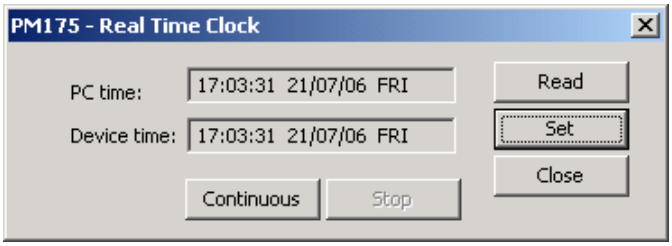


To clear the device diagnostics events, click on Clear.

Updating the Clock

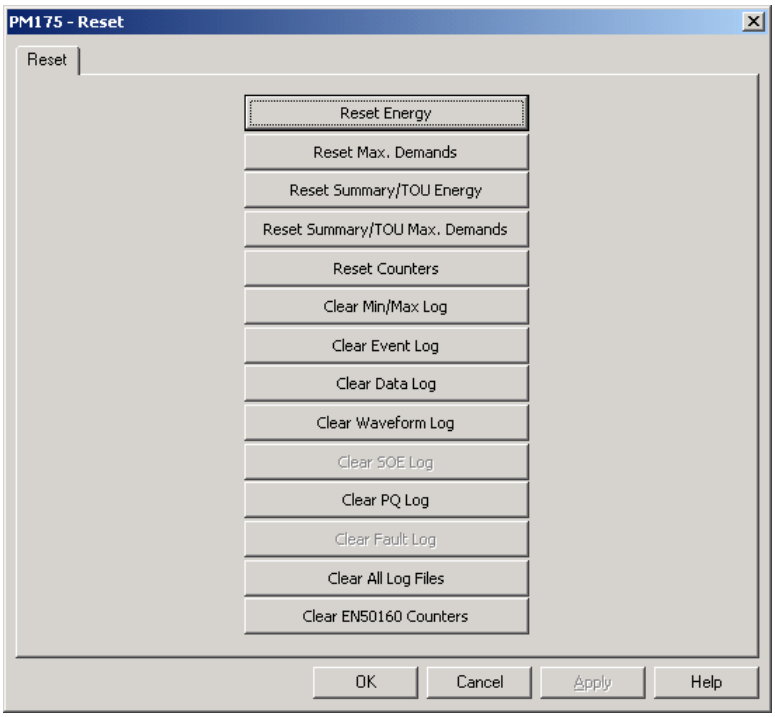
To update the Real-Time Clock (RTC) in your device, check the On-line button on the PAS toolbar, and then select RTC from the Monitor menu or click on the Real-Time Clock button on the PAS toolbar.

The RTC dialog box displays the current PC time and the time in your device. To synchronize the device clock with the PC clock, click Set.



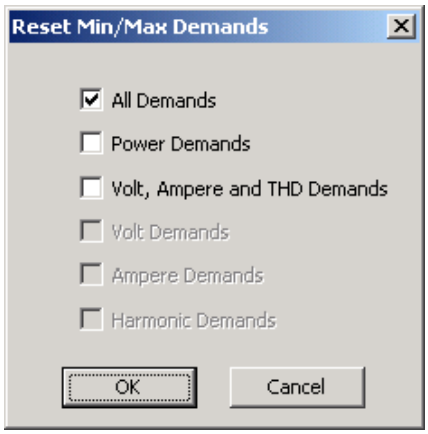
Resetting Accumulators and Clearing Log Files

PAS allows you to remotely clear energy accumulators, maximum demands, Min/Max log registers, counters and log files in your device. To open the dialog, check the On-line button, and then select Reset from the Monitor menu.



To reset the desired accumulation registers or to clear a file:

1. Click on the corresponding button, and then confirm your command.
2. If a target has more than one component, you are allowed to select components to reset.



3. Check the corresponding boxes, and then click OK.

Administration

Changing a Password

PAS allows you to remotely change the password, and enable or disable the password security check in your meter. To change the password, check the On-line button, select Administration from the Monitor menu, and then select Change Password.

To change the password:

1. Type in a new 4-digit password.
2. Repeat the password in the Confirm box.
3. Check the “Enable network protection” to enable password checking.
4. Click Send.

Upgrading Device Firmware

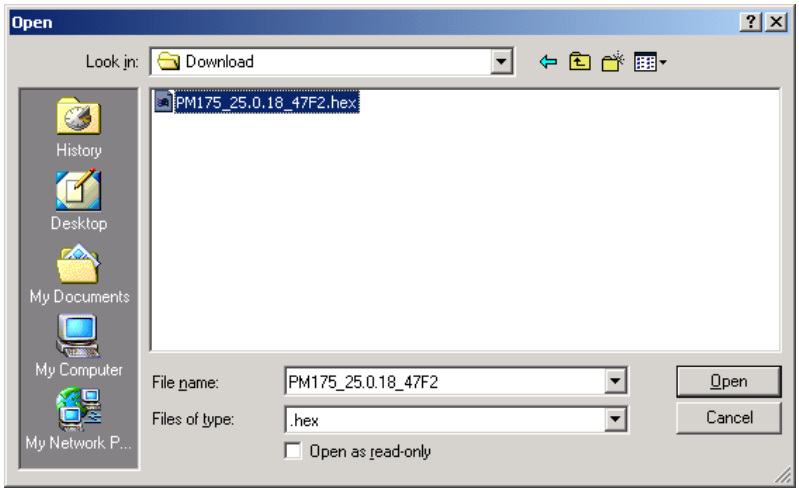
Your meter has upgradeable firmware. If you need to upgrade your device, download a new firmware file to the meter through PAS.

Firmware is downloaded through any communication port. The meter may be connected to your PC through a serial interface, a dial-up modem or the Internet.

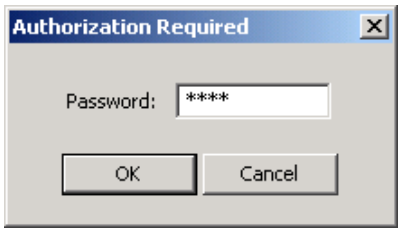
Upgrading firmware is only supported through the Modbus RTU and Modbus/TCP protocols, so your serial port or modem port should be put into Modbus RTU mode.

To download a new firmware file to your device:

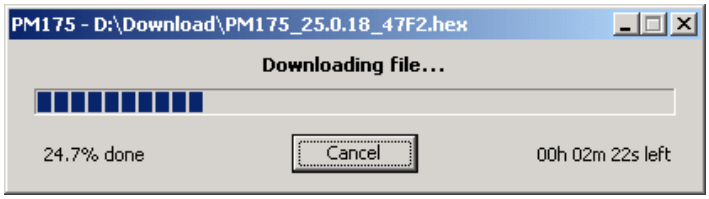
1. Ensure that the communication port you are connected through to the meter operates in Modbus RTU mode.
2. If the port is configured for a different protocol, put it into Modbus RTU mode either from the front display, or remotely through PAS. If you are connected to the meter through a serial interface, it is recommended to set the port baud rate to 115,200 bps. See Configuring Communications in your Meter on how to remotely change the protocol and baud rate in your meter.
3. Check the On-line button on the PAS toolbar, select Flash Downloader from the Monitor menu, and then confirm changes.



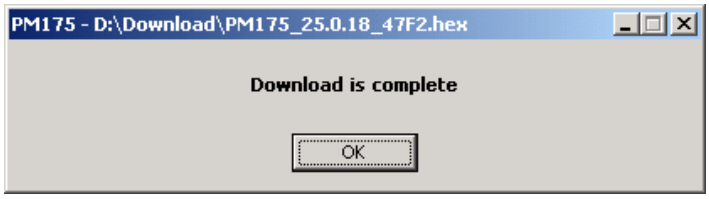
4. Point to the firmware upgrade file for your meter, click Open, and then confirm upgrading the meter. You are asked for the password regardless of the password protection setting in your meter.



5. Type the meter password, and click OK. If you did not change the password in the meter, enter the default password 0.



6. Wait until PAS completes upgrading your device. It takes about 3-4 minutes at 115,200 bps to download the file to the meter.

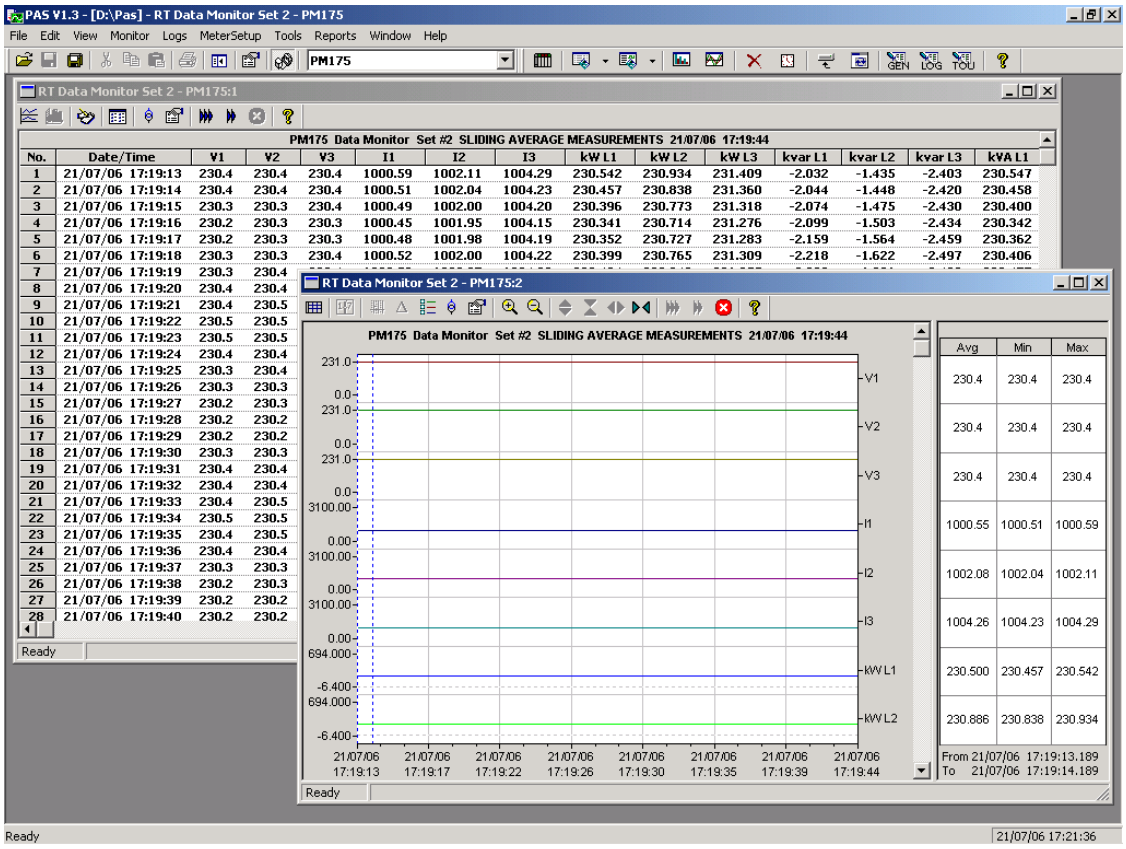


7. After upgrading firmware is completed, the meter restarts, so if it is connected through the modem to your PC, communications can be temporarily lost. You may need to wait a short duration until PAS restores a connection with your device.
8. You possibly need to restore the previous port settings in your meter if you changed them.

Monitoring Devices

Viewing Real-time Data

Real-time data is continuously retrieved from your devices, updated on the screen at the rate you defined in the Instrument Setup, and can be recorded to a file. You can view acquired data in a tabular or in a graphical form as a data trend.



For information on the real-time data monitoring and recording options, see the “PAS Getting Started Guide”.

Any data, energy and maximum demand registers in your meters can be read and recorded to files through the PAS Data Monitor. See Appendix D for a list of data available in your meter.

Viewing Min/Max Log

To retrieve the real-time Min/Max log data from your device, select the device site from the list box on the toolbar, select RT Min/Max Log from the Monitor menu, and then select a data set you want to view.

For more information on the Min/Max data monitoring options, see the “PAS Getting Started Guide”.

Viewing Real-time Waveforms

The PM175 allows you to retrieve and view the real-time waveforms from your meter.

The waveforms can be displayed in different views as overlapped or non-overlapped waveforms, as RMS cycle-by-cycle plot, or as a harmonic spectrum chart or table. For information on using different waveform views, see the “PAS Getting Started Guide”.

Retrieving Log Files

Retrieving Recorded Data

Using PAS, you can retrieve recorded events, data and waveforms from your meters and save them to files on your PC in the MS Access database format.

Historical data can be uploaded on demand any time you need it, or periodically through the Upload Scheduler that can retrieve data automatically on a predefined schedule, for example, daily, weekly or monthly. If you do not change the destination database location, new data will be added to the same database so you can have long-term data profiles in one database regardless of the upload schedule you selected.

For information on uploading files and configuring the Upload Scheduler for your meters, see the “PAS Getting Started Guide”.

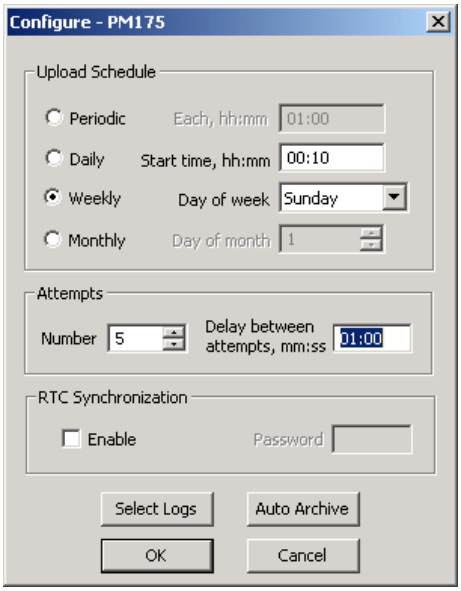
Retrieving EN50160 Statistics Files

The EN50160 statistics files and present contents of the EN50160 evaluation counters can be retrieved by PAS and stored to a database for later analysis.

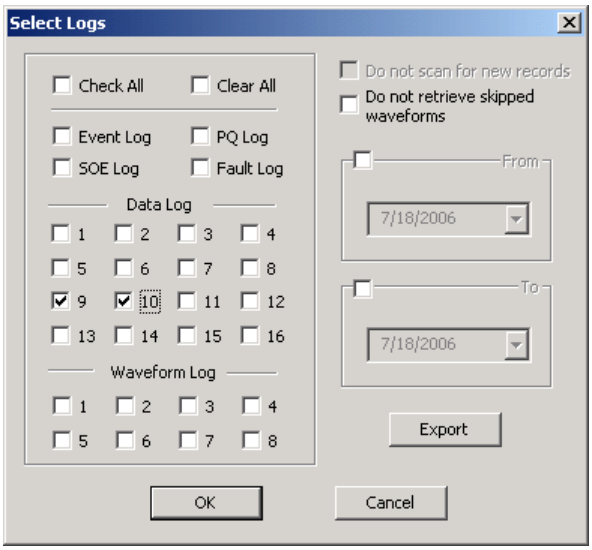
Using the Upload Scheduler

The PAS Upload Scheduler can automatically retrieve the EN50160 statistics files on a daily or weekly basis depending on the EN50160 evaluation period selected in your device.

Select the Daily or Weekly schedule for the EN50160 statistics files when configuring the upload schedule (see “Using the Upload Scheduler” in the “PAS Getting Started Guide”).



Check the Data log #9 and #10 boxes in the Select Logs dialog box for uploading the EN50160 Compliance Statistics and EN50160 Harmonics Survey files respectively, as shown in the following picture.



Retrieving EN50160 Statistics Files on Demand

To manually retrieve the EN50160 statistics files on demand, select “Upload EN50160 Compliance Stats” from the Logs menu and specify the database to which you want the data to be stored.

Retrieving the EN50160 Online Statistics

To retrieve the present contents of the EN50160 statistics counters accumulated since the beginning of the current evaluation period, select “Upload EN50160 Online Stats” from the Logs menu and specify the database to which you want the data to be stored. The statistics records will be marked as online events.

See Viewing the EN50160 Online Statistics Report for information on how to get the EN50160 compliance report for the latest online statistics stored in the database.

Viewing Recorded Files

Viewing Options

Uploaded data can be viewed on the screen, printed, and exported to other applications.

PAS offers you different options for easy analysis of retrieved trend and fault data. Data can be displayed in primary or secondary units. You can use filtering to find out and work with a subset of events that meet the criteria you specify, or use sorting to rearrange records in the desired order. PAS can link events and the corresponding data records and waveforms together to allow you more effective analysis of recorded events.

For data log files, PAS allows you to view data trends in a graphical form, measure the delta time and magnitude between two trend points, calculate average and peak values within time intervals.

For waveform files, PAS provides phasor diagrams, symmetrical components and delta measurements, and can show you a waveform as an RMS plot or as a spectrum chart.

For more information on viewing log files and available options, see the “PAS Getting Started Guide”.

Viewing the EN50160 Power Quality Event Log

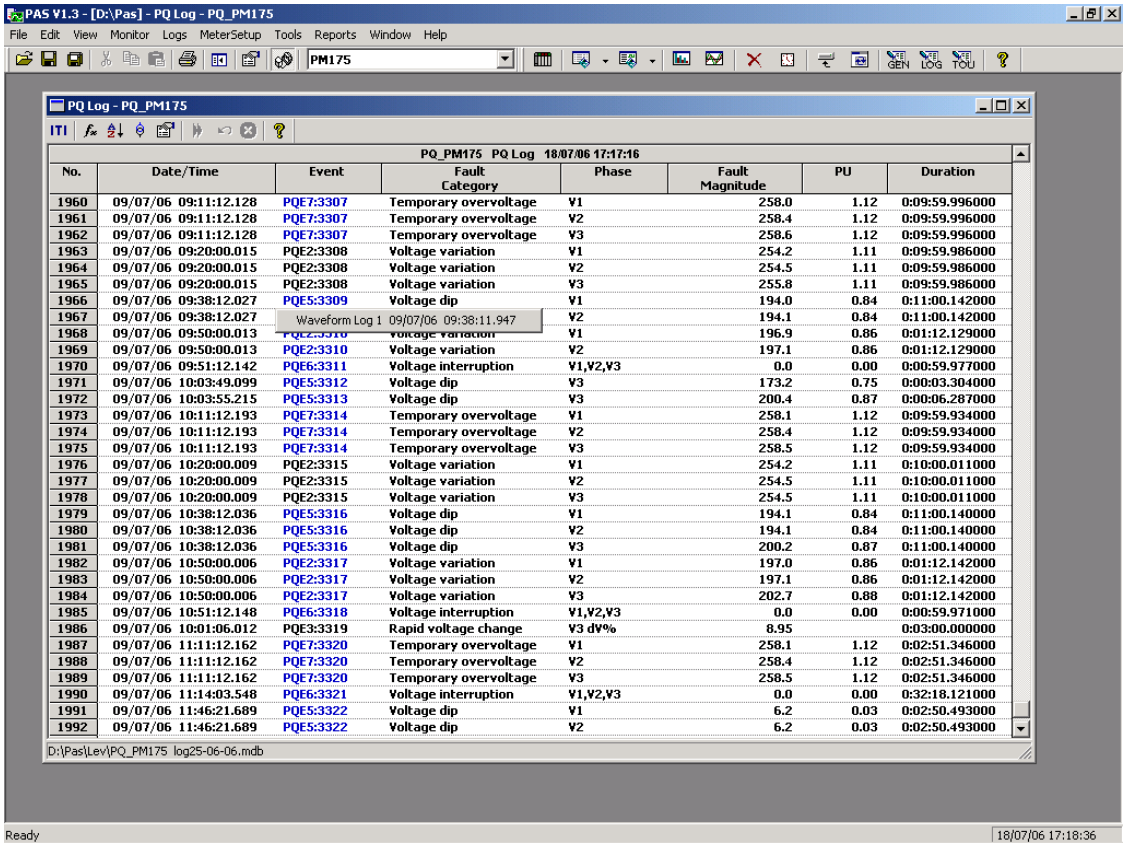
PQ log files are displayed in a tabular view, one event per row. PAS loads the entire database table to a window, so that you can scroll through the log to view its contents.

Selecting Voltage Units

Voltages can be displayed in primary or secondary units. To change units for your reports, click with the right mouse button on the report window, select Options, select the desired voltage units, and then click OK.

Sorting Events

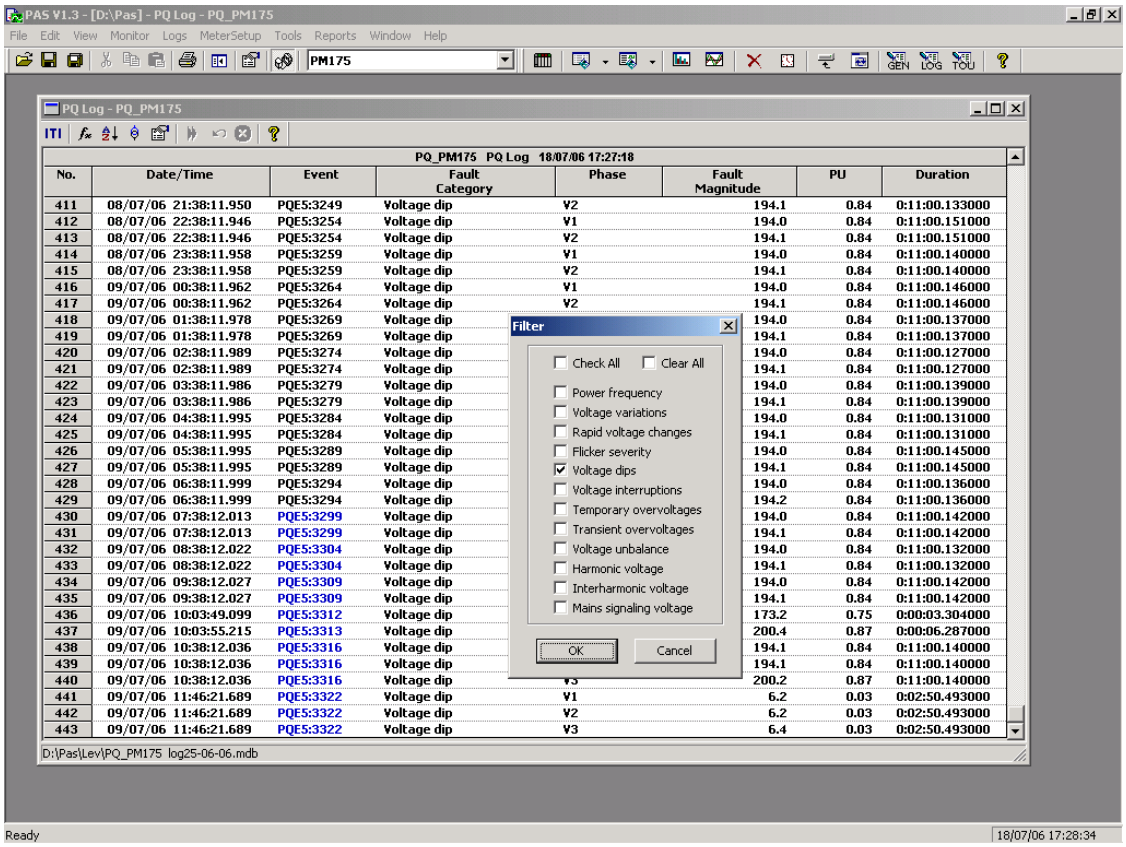
The event records are normally shown in the order based on the date and time of the event appearance. To change the sorting order, click on the Sort button on the window toolbar or click with the right mouse button on the report window and select “Sort...”, check the desired sort order, and then click OK.



Filtering Events

You can use filtering to find and work with a subset of events that meet the criteria you specify. PAS will temporary hide rows you do not want displayed. You can use a filter along with sorting to rearrange filtered records in the desired order.

To filter events, click on the Filter button on the window toolbar, or click with the right mouse button on the report window, and then select “Filter...”. Check the categories of events you want to display, and then click OK.



Linking to Waveforms

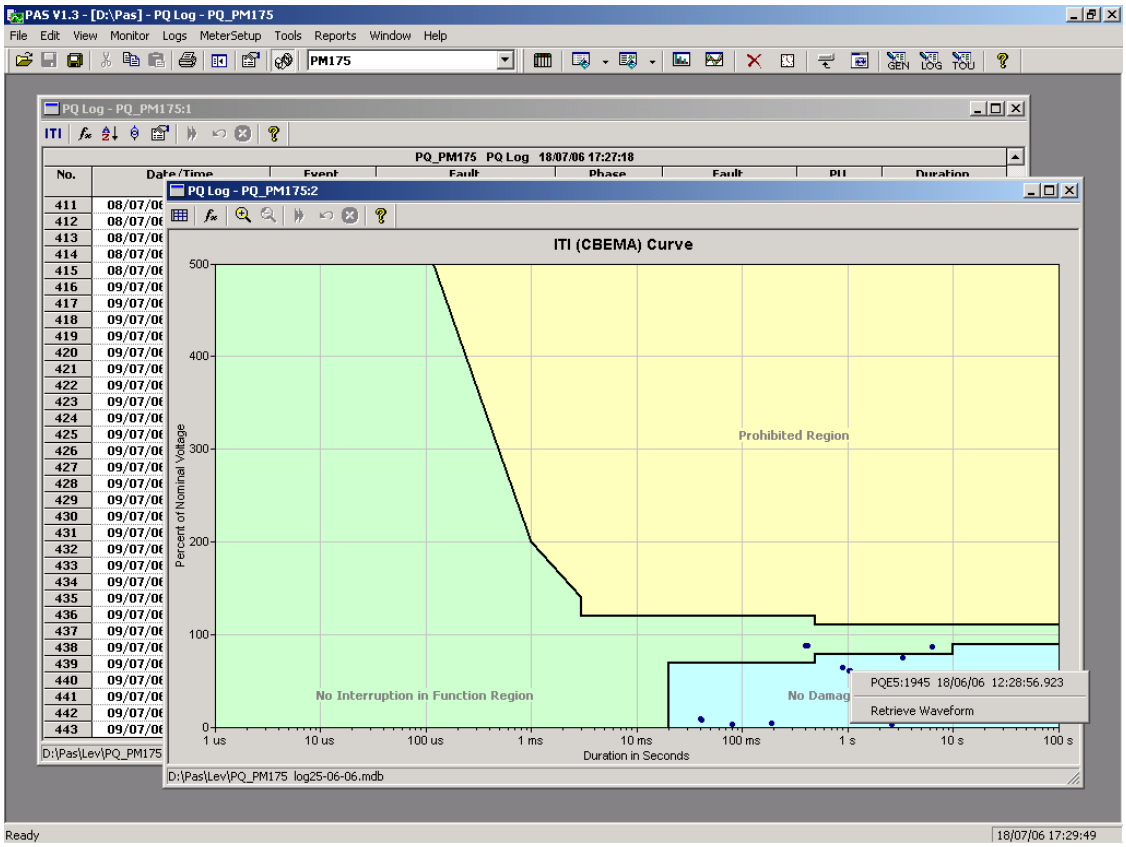
When displaying the PQ report, PAS establishes links between the events and waveform log records related to the events. PQ events, for which PAS finds related links, are displayed in blue. To check a list of the event links, click on the colored event ID with the left mouse button. To directly move to the related waveform record, click on the corresponding list item.

Retrieving Waveforms Online

If you programmed the PQ recorder to record waveforms on power quality events, you can upload the waveforms related to a specific event online if they have not yet been retrieved and stored to the database on your PC. Events for which PAS did not find a corresponding waveform in the database are colored black. Click on the event ID, click on the “Retrieve Waveform” prompt, and then point to a database to which you want the waveform to be stored.

Viewing the ITI (CBEMA) Curve

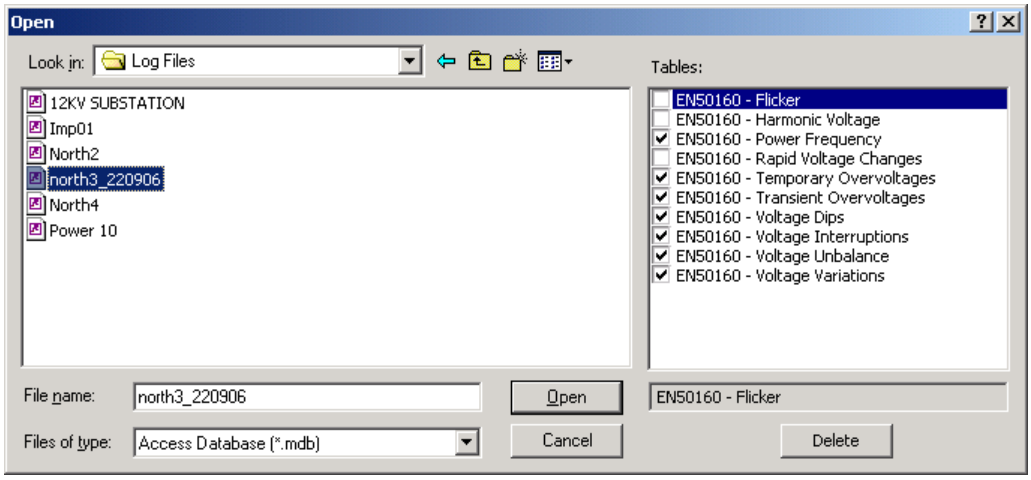
Transient overvoltages (impulsive transients) and short-duration voltage variations (dips and temporary overvoltages) can be viewed as magnitude/duration pairs on the ITIC (the Information Technology Industry Council, formerly CBEMA) curve chart. To view an ITI curve chart, click on the “ITI” button on the window toolbar.



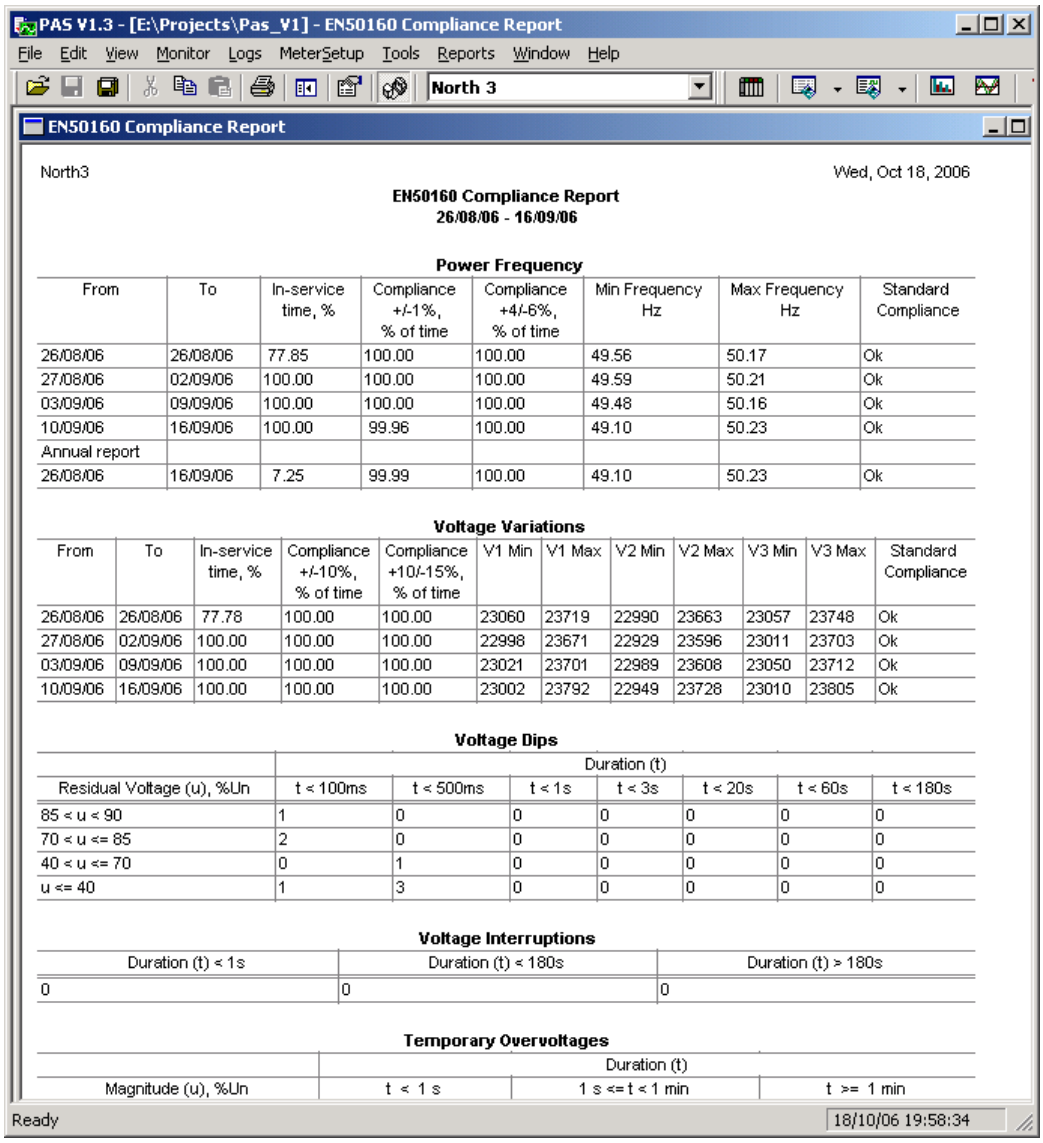
To view the event details, click on the event point with the left mouse button. To directly move to the related power quality report entry or to a waveform record, click on the corresponding list item with the left mouse button.

Viewing the EN50160 Compliance Report

To get the EN50160 Compliance report on the collected statistics data, select “EN50160 Compliance Statistics” from the Reports menu, point to the database where you stored the retrieved statistics, uncheck the voltage characteristics’ tables which you do not want to be reported, and then click Open.



The following picture shows an example of the EN50160 compliance report.


PAS V1.3 - [E:\Projects\Pas_V1] - EN50160 Compliance Report
File Edit View Monitor Logs MeterSetup Tools Reports Window Help
North 3
EN50160 Compliance Report
North3
Wed, Oct 18, 2006
EN50160 Compliance Report
26/08/06 - 16/09/06
Power Frequency
From | To | In-service time, % | Compliance +/-1%, % of time | Compliance +4/-6%, % of time | Min Frequency Hz | Max Frequency Hz | Standard Compliance
26/08/06 | 26/08/06 | 77.85 | 100.00 | 100.00 | 49.56 | 50.17 | Ok
27/08/06 | 02/09/06 | 100.00 | 100.00 | 100.00 | 49.59 | 50.21 | Ok
03/09/06 | 09/09/06 | 100.00 | 100.00 | 100.00 | 49.48 | 50.16 | Ok
10/09/06 | 16/09/06 | 100.00 | 99.96 | 100.00 | 49.10 | 50.23 | Ok
Annual report
26/08/06 | 16/09/06 | 7.25 | 99.99 | 100.00 | 49.10 | 50.23 | Ok
Voltage Variations
From | To | In-service time, % | Compliance +/-10%, % of time | Compliance +10/-15%, % of time | V1 Min | V1 Max | V2 Min | V2 Max | V3 Min | V3 Max | Standard Compliance
26/08/06 | 26/08/06 | 77.78 | 100.00 | 100.00 | 23060 | 23719 | 22990 | 23663 | 23057 | 23748 | Ok
27/08/06 | 02/09/06 | 100.00 | 100.00 | 100.00 | 22998 | 23671 | 22929 | 23596 | 23011 | 23703 | Ok
03/09/06 | 09/09/06 | 100.00 | 100.00 | 100.00 | 23021 | 23701 | 22989 | 23608 | 23050 | 23712 | Ok
10/09/06 | 16/09/06 | 100.00 | 100.00 | 100.00 | 23002 | 23792 | 22949 | 23728 | 23010 | 23805 | Ok
Voltage Dips
Duration (t)
Residual Voltage (u), %Un | t < 100ms | t < 500ms | t < 1s | t < 3s | t < 20s | t < 60s | t < 180s
85 < u < 90 | 1 | 0 | 0 | 0 | 0 | 0 | 0
70 < u <= 85 | 2 | 0 | 0 | 0 | 0 | 0 | 0
40 < u <= 70 | 0 | 1 | 0 | 0 | 0 | 0 | 0
u <= 40 | 1 | 3 | 0 | 0 | 0 | 0 | 0
Voltage Interruptions
Duration (t) < 1s | Duration (t) < 180s | Duration (t) > 180s
0 | 0 | 0
Temporary Overvoltages
Duration (t)
Magnitude (u), %Un | t < 1 s | 1 s <= t < 1 min | t >= 1 min
Ready
18/10/06 19:58:34

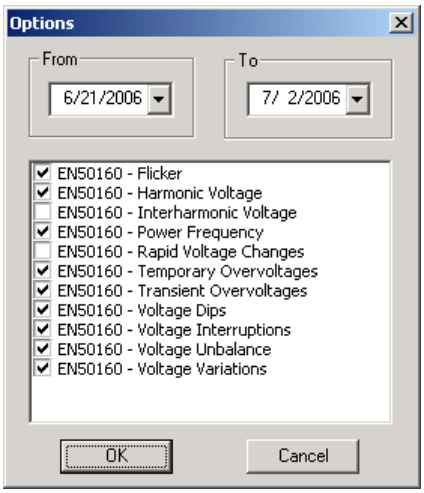
The standard compliance statistics is reported within the selected time range on a daily, weekly or yearly basis depending on the observation periods stated in the EN50160 for voltage characteristics. If the time range includes a number of the observation intervals, each interval's statistics is given in a separate row. For power frequency, both weekly and yearly compliance statistics are provided.

For characteristics provided with definite limits, the report shows a percentage of the observation time within which the characteristic complied with the standard, e.g. 98% of the observations in a period of one week, and the total compliance indicator.

For voltage characteristics provided with indicative values, the report gives the yearly statistical data classified by voltage magnitude and duration.

Selecting the Report Time Range

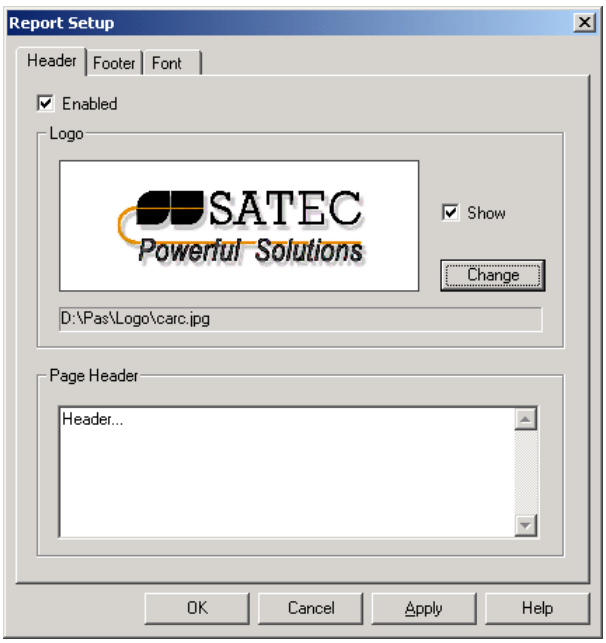
To change the time range or contents of the report, click on the report with the right mouse button, select "Options…", select the required time range, check the voltage characteristics to be included in the report, and then click OK.



Customizing Reports

If you wish to add a logo image, header and footer to your reports:

1. Select “Report Setup…” from the Reports menu, or click on the report window with the right mouse button, and then select “Report Setup…”.



2. Click on the Change button and select a logo image file. Check the “Show” box to include your logo into a report.
3. Type the header text in the Page Header box. Check the “Enabled” box to include the header into a report.
4. Click on the Footer tab and type the footer text. Check the “Enabled” box to include the footer into a report.
5. Click OK.

Both the header and the footer may contain more than one line of the text. Use the Enter button to move to the next line as usually.

Printing Reports

To get a hardcopy of the report on the printer, select Print… from the File menu. To check the report, as it will look when printed, select Print Preview from the File menu.

Viewing the EN50160 Online Statistics Report

If you retrieved the EN50160 online statistics data, you can get the online report on the last retrieved statistics in the same manner as the EN50160 Compliance statistics report. Select “EN50160 Online Statistics” from the Reports menu, point to the database where you stored the retrieved online statistics, uncheck the voltage characteristics’ tables that you do not want to be reported, and then click Open.

Viewing the EN50160 Harmonics Survey Report

To get the EN50160 harmonics survey report on the collected statistics data, select “EN50160 Harmonics Survey” from the Reports menu, point to the database where you stored the retrieved statistics, uncheck the voltage channels which you do not want to be reported, and then click Open.

Appendix A Technical Specifications

Environmental Conditions

Operating temperature: -20°C to 60°C (-4°F to 140°F)
Storage temperature: -25°C to 80°C (-13°F to 176°F)
Humidity: 0 to 95% non-condensing

Construction

Dimensions see Figure 2-1

Weight: 1.23kg (2.7 lb.)

Materials

Case enclosure: plastic PC/ABS blend
Display body: plastic PC/ABS blend
Front panel: plastic PC
PCB.: FR4 (UL94-V0)
Terminals: PBT (UL94-V0)
Connectors-Plug-in type: Polyamide PA6.6 (UL94-V0)
Packaging case: Carton and Stratocell® (Polyethylene Foam) brackets
Labels: Polyester film (UL94-V0)

Power Supply

120/230 VAC-110/220 VDC Option:
Rated input 85-264VAC 50/60 Hz, 88-290VDC, Burden 10W
Isolation:
Input to output: 3000 VAC
Input to ground: 2000 VAC
12 VDC Option: Rated input 9.6-19 VDC
24 VDC Option: Rated input 19-37 VDC
48 VDC Option: Rated input 37- 72 VDC
Wire size: up to 12 AWG (up to 3.5 mm^2)

Input Ratings

Voltage Inputs

Operating range: 690VAC line-to-line, 400VAC line-to-neutral
Direct input and input via PT (up to 828VAC line-to-line, up to 480VAC line-to-neutral)
Input impedance: 500 kOhm
Burden for 400V: < 0.4 VA
Burden for 120V: < 0.04 VA
Overvoltage withstand: 1000 VAC continuous, 2000 VAC for 1 second
Galvanic isolation: 3500 VAC
Wire size: up to 12 AWG (up to 3.5mm^2)

Current Inputs

Wire size: 12 AWG (up to 3.5 mm^2)
Galvanic isolation: 3500 VAC

5A secondary

Operating range: continuous 10A RMS Burden: < 0.1 VA
Overload withstand: 15A RMS continuous, 300A RMS for 1 second

1A secondary

Operating range: continuous 2A RMS Burden: < 0.02 VA
Overload withstand: 6A RMS continuous, 80A RMS for 1 second

Relay Outputs

2 relays rated at 3A/250 VAC; 3A/30 VDC, 2 contacts (SPST Form A)
Wire size: 14 AWG (up to 1.5 mm^2)
Galvanic isolation:
- Between contacts and coil: 2000 VAC 1 min
- Between open contacts: 1000 VAC

Operate time: 10 ms max.
Release time: 5 ms max.
Update time: 1 cycle

Digital Inputs

2 Digital Inputs Dry Contacts
Wire size: 14 AWG (up to 1.5 mm^2)
Galvanic isolation: 2000V RMS
Internal power supply 15V
Scan time: 1 ms

Optional Analog Inputs

2 Analog Inputs (optically isolated)
Ranges (upon order):
- ±1 mA (100% overload)
- 0-20 mA
- 4-20 mA
- 0-1 mA (100% overload)

Wire size: 14 AWG (up to 1.5 mm^2)
Isolation: 2,000 V RMS
Accuracy: 0.5% FS
Scan time: 1 cycle

Optional Analog Outputs

2 Analog Outputs (optically isolated)
Ranges (upon order):
- ±1 mA, maximum load 5 kΩ (100% overload)
- 0-20 mA, maximum load 510 Ω
- 4-20 mA, maximum load 510 Ω
- 0-1 mA, maximum load 5 k Ω (100% overload)

Isolation: 2,000 V RMS
Power supply: internal
Accuracy: 0.5% FS
Wire size: 14 AWG (up to 1.5 mm^2)
Update time: 1 cycle

Communication Ports

COM1 (Optional modules)

Serial EIA RS-232 optically isolated port

Isolation: 2,000 V RMS
Connector type: DB9 female.
Baud rate: up to 115.2 kbps.
Supported protocols: Modbus RTU and Modbus ASCII.

RS-422/RS-485 optically isolated port

Isolation: 2,000 V RMS
Connector type: DB9 female.
Baud rate: up to 115.2 kbps.
Supported protocols: Modbus RTU and Modbus ASCII.

Ethernet Port

Transformer-isolated 10/100BaseT Ethernet port.
Connector type: RJ45 modular.
Supported protocols: Modbus/TCP (Port 502).
Number of simultaneous connections: 2.

Dial-up Modem

Transformer-isolated internal 56K modem.
Connector type: RJ11.
Supported protocols: Modbus RTU and Modbus ASCII.

COM2

RS-422/RS-485 optically isolated port

Isolation: 2,000 V RMS
Connector type: removable, 5 pins.
Wire size: up to 14 AWG (up to 1.5 mm^2).
Baud rate: up to 115.2 kbps.
Supported protocols: Modbus RTU and Modbus ASCII.

Real-time Clock

Accuracy: typical error 15 seconds per month @ 25°C

Log Memory

Onboard memory with battery backup: 1 Mbytes.

Display Module

Display: high-brightness seven-segment digital LEDs, two 4-digit + one 6-digit windows
Keypad: 6 push buttons
Communication: EIA RS-485 port with 12V supply voltage
Connector type: DB15, 15 pins
Wires size: up to 14 AWG (up to 1.5 mm^2)
Distance: up to 1000 m (3200 feet)

Standards Compliance

Accuracy per ANSI C12.20 –1998

UL File # E129258 (PENDING)

Directive complied with:

EMC: 89/336/EEC as amended by 92/31/EEC and 93/68/EEC

LVD: 72/23/EEC as amended by 93/68/EEC and 93/465/EEC

Harmonized standards to which conformity is declared:

EN55011: 1991

EN50082-1: 1992

EN61010-1: 1993

A2/1995

EN50081-2 Generic Emission Standard - Industrial Environment

EN50082-2 Generic Immunity Standard - Industrial Environment

EN55022: 1994 Class A

EN61000-4-2

ENV50140: 1983

ENV50204: 1995 (900MHz)

ENV50141: 1993

EN61000-4-4:1995

EN61000-4-8: 1993

Measurement Specifications

Parameter	Full Scale @ Input Range	Accuracy			Range
		% Reading	% FS	Conditions	
Voltage	120VxPT @ 120V 400VxPT @ 690V	0.2	0.01	10% to 120% FS	0 to 1,150,000 V Starting voltage 1.5% FS @ 120V 1.5% FS @ 690V
Line current	CT	0.2	0.02	1% - 200% FS	0 to 10,000 A Starting current 0.1% FS
Active power	0.36×PT×CT @ 120V 1.2×PT×CT @ 690V	0.2	0.02	|PF| ≥ 0.5 1	-10,000,000 kW to +10,000,000 kW
Reactive power	0.36×PT×CT @ 120V 1.2×PT×CT @ 690V	0.3	0.04	|PF| ≤ 0.9 1	-10,000,000 kvar to +10,000,000 kvar
Apparent power	0.36×PT×CT @ 120V 1.2×PT×CT @ 690V	0.2	0.02	|PF| ≥ 0.5 1	0 to 10,000,000 kVA
Power factor	1.000		0.2	|PF| ≥ 0.5, I ≥ 2% FSI	-0.999 to +1.000
Frequency		0.02			15 Hz to 480 Hz
Total Harmonic Distortion, THD V (I), %Vf (%If)	999.9	1.5	0.1	THD ≥ 1%, V (I) ≥ 10% FSV (FSI)	0 to 999.9
Total Demand Distortion, TDD, %	100		1.5	TDD ≥ 1%, I ≥ 10% FSI	0 to 100
Active energy Import & Export		Class 0.2S under conditions as per IEC 62053-22:2003			0 to 999,999.999 MWh
Reactive energy Import & Export		Class 0.2S under conditions as per IEC 62053-22:2003, |PF| ≤ 0.9			0 to 999,999.999 Mvarh
Apparent energy		Class 0.2S under conditions as per IEC 62053-22:2003			0 to 999,999.999 MVAh

[1] @ 80% to 120% of voltage FS, 1% to 200% of current FS, and frequency 50/60 Hz

PT - external potential transformer ratio
CT - primary current rating of external current transformer
FSV - voltage full scale
FSI - current full scale
V_f - fundamental voltage
I_f - fundamental current

NOTES

1. Accuracy is expressed as ± (percentage of reading + percentage of full scale) ± 1 digit. This does not include inaccuracies introduced by the user's potential and current transformers. Accuracy calculated at 1second average.
2. Specifications assume: voltage and current waveforms with THD ≤ 5% for kvar, kVA and PF, and reference operating temperature 20°C - 26°C.
3. Measurement error is typically less than the maximum error indicated.

Appendix B Parameters for Analog Output

The following table lists parameters that can be provided on the meter's analog outputs.

Display Code	Designation	Description
nonE	NONE	None (output disabled)
		1-Cycle Phase Values
rt.U1	V1/12 RT [1]	V1/V12 Voltage
rt.U2	V2/23 RT [1]	V2/V23 Voltage
rt.U3	V3/31 RT [1]	V3/V31 Voltage
rt.U12	V12 RT	V12 Voltage
rt.U23	V23 RT	V23 Voltage
rt.U31	V31 RT	V31 Voltage
rt.C1	I1 RT	I1 Current
rt.C2	I2 RT	I2 Current
rt.C3	I3 RT	I3 Current
		1-Cycle Total Values
rt.Ac.P	kW RT	Total kW
rt.rE.P	kvar RT	Total kvar
rt.AP.P	kVA RT	Total kVA
rt.PF	PF RT	Total PF
rt.PF.LG	PF LAG RT	Total PF Lag
rt.PF.Ld	PF LEAD RT	Total PF Lead
rt.U.AG	VOLT AVG RT [1]	3-phase average L-N/L-L voltage
rt.UL.AG	VOLT AVG LL RT	3-phase average L-L voltage
rt.C.AG	AMPS AVG RT	3-phase average current
		1-Cycle Auxiliary Values
rt.nEU.C	In RT	In Current
rt.FrEq	FREQ RT	Frequency
		1-Sec Phase Values
Ar.U1	V1/12 AVR [1]	V1/V12 Voltage
Ar.U2	V2/23 AVR [1]	V2/V23 Voltage
Ar.U3	V3/31 AVR [1]	V3/V31 Voltage
Ar.U12	V12 AVR	V12 Voltage
Ar.U23	V23 AVR	V23 Voltage
Ar.U31	V31 AVR	V31 Voltage
Ar.C1	I1 AVR	I1 Current
Ar.C2	I2 AVR	I2 Current
Ar.C3	I3 AVR	I3 Current
		1-Sec Total Values
Ar.Ac.P	kW AVR	Total kW
Ar.rE.P	kvar AVR	Total kvar
Ar.AP.P	kVA AVR	Total kVA
Ar.PF	PF AVR	Total PF
Ar.PF.LG	PF LAG AVR	Total PF Lag
Ar.PF.Ld	PF LEAD AVR	Total PF Lead
Ar.U.AG	VOLT AVG AVR [1]	3-phase average L-N/L-L voltage
Ar.UL.AG	VOLT AVG LL AVR	3-phase average L-L voltage
Ar.C.AG	AMPS AVG AVR	3-phase average current
		1-Sec Auxiliary Values
rt.nEU.C	In AVR	In Current
rt.FrEq	FREQ AVR	Frequency
		Present Demands
d.P.i	kW IMP ACC DMD	Accumulated kW import demand
d.P.E	kW EXP ACC DMD	Accumulated kW export demand
d.q.i	kvar IMP ACC DMD	Accumulated kvar import demand
d.q.E	kvar EXP ACC DMD	Accumulated kvar export demand
d.S	kVA ACC DMD	Accumulated kVA demand

5. [1] In 4LN3, 4LL3, 3LN3, 3LL3, 3BLN3 and 3BLL3 wiring modes, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

6.

Appendix C Setpoint Triggers and Actions

Setpoint Triggers

Display Code	Designation	Description
nonE	NONE	None (condition is not active)
		Status Inputs
St1.On	STAT INP #1 ON	Status input #1 ON
St2.On	STAT INP #2 ON	Status input #2 ON
St1.OFF	STAT INP #1 OFF	Status input #1 OFF
St1.OFF	STAT INP #2 OFF	Status input #2 OFF
		Relays
rL1.On	RELAY #1 ON	Relay #1 ON
rL2.On	RELAY #2 ON	Relay #2 ON
rL1.OFF	RELAY #1 OFF	Relay #1 OFF
rL2.OFF	RELAY #2 OFF	Relay #2 OFF
		Static Events
POS.Ph.r	POS PHASE REVERSAL	Positive phase rotation reversal
nEG.Ph.r	NEG PHASE REVERSAL	Negative phase rotation reversal
Pq.E	PQ EVENT	EN50160 PQ event
		Analog Inputs
A.In1.Hi	HI AI1	High analog input #1
A.In2.Hi	HI AI2	High analog input #2
A.In1.Lo	LO AI1	Low analog input #1
A.In1.Lo	LO AI2	Low analog input #2
		1-Cycle Phase Values
rtHi.C1	HI I1 RT	High I1 current
rtHi.C2	HI I2 RT	High I2 current
rtHi.C3	HI I3 RT	High I3 current
rtLo.C1	LO I1 RT	Low I1 current
rtLo.C2	LO I2 RT	Low I2 current
rtLo.C3	LO I3 RT	Low I3 current
		1-Cycle Values on any Phase
rtHi. U	HI VOLT RT [1]	High voltage
rtLo. U	LO VOLT RT [1]	Low voltage
rtHi. C	HI AMPS RT	High current
rtLo. C	LO AMPS RT	Low current
rtthd.U	HI V THD [1]	High voltage THD
rtthd.C	HI I THD	High current THD
rtHFc.C	HI KF RT	High K-Factor
rttdd.C	HI I TDD	High current TDD
		1-Cycle Auxiliary Values
rtHi.Fr	HI FREQ RT	High frequency
rtLo.Fr	LO FREQ RT	Low frequency
rtHU.Ub	HI V UNB% RT [1]	High voltage unbalance
		1-Sec Phase Values
ArHi.C1	HI I1 AVR	High I1 current
ArHi.C2	HI I2 AVR	High I2 current
ArHi.C3	HI I3 AVR	High I3 current
ArLo.C1	LO I1 AVR	Low I1 current
ArLo.C2	LO I2 AVR	Low I2 current
ArLo.C3	LO I3 AVR	Low I3 current
		1-Sec Values on any Phase
ArHi. U	HI VOLT AVR [1]	High voltage
ArLo. U	LO VOLT AVR [1]	Low voltage
ArHi. C	HI AMPS AVR	High current
ArLo. C	LO AMPS AVR	Low current
		1-Sec Total Values
ArHi.P.i	HI kW IMP AVR	High total kW import
ArHi.P.E	HI kW EXP AVR	High total kW export
ArHi.q.i	HI kvar IMP AVR	High total kvar import
ArHi.q.E	HI kvar EXP AVR	High total kvar export
ArHi. S	HI kVA AVR	High total kVA

Display Code	Designation	Description
ArPF.LG	HI PF LAG AVR	Low total PF Lag
ArPF.Ld	HI PF LEAD AVR	Low total PF Lead
		1-Sec Auxiliary Values
ArnEU.C	HI In AVR	High neutral current
ArHi.Fr	HI FREQ RT	High frequency
ArLo.Fr	LO FREQ RT	Low frequency
ArHU.Ub	HI V UNB% RT	High voltage unbalance
		Present Demands
Hi d.U1	HI V1/12 DMD [1]	High V1/V12 Volt demand
Hi d.U2	HI V2/23 DMD [1]	High V2/V23 Volt demand
Hi d.U3	HI V3/31 DMD [1]	High V3/V31 Volt demand
Hi d.C1	HI I1 DMD	High I1 Ampere demand
Hi d.C2	HI I2 DMD	High I2 Ampere demand
Hi d.C3	HI I3 DMD	High I3 Ampere demand
Hi d.P.i	HI kW IMP BD	High block kW import demand
Hi d.P.E	HI kW EXP BD	High block kW export demand
Hi d.q.i	HI kvar IMP BD	High block kvar import demand
Hi d.q.i	HI kvar EXP BD	High block kvar export demand
Hi d. S	HI kVA BD	High block kVA demand
HiSd.P.i	HI kW IMP SD	High sliding window kW import demand
HiSd.P.E	HI kW EXP SD	High sliding window kW export demand
HiSd.q.i	HI kvar IMP SD	High sliding window kvar import demand
HiSd.q.i	HI kvar EXP SD	High sliding window kvar export demand
HiSd. S	HI kVA SD	High sliding window kVA demand
HiAd.P.i	HI kW IMP ACC DMD	High accumulated kW import demand
HiAd.P.E	HI kW EXP ACC DMD	High accumulated kW export demand
HiAd.q.i	HI kvar IMP ACC DMD	High accumulated kvar import demand
HiAd.q.i	HI kvar EXP ACC DMD	High accumulated kvar export demand
HiAd. S	HI kVA ACC DMD	High accumulated kVA demand
HiPd.P.i	HI kW IMP PRD DMD	High predicted kW import demand
HiPd.P.E	HI kW EXP PRD DMD	High predicted kW export demand
HiPd.q.i	HI kvar IMP PRD DMD	High predicted kvar import demand
HiPd.q.i	HI kvar EXP PRD DMD	High predicted kvar export demand
HiPd. S	HI kVA PRD DMD	High predicted kVA demand
		Pulse Inputs
PLS.In.1	PULSE INPUT #1	Pulse input #1
PLS.In.2	PULSE INPUT #2	Pulse input #2
		Internal Events
PLS.Ac.i	kWh IMP PULSE	kWh import pulse
PLS.Ac.E	kWh EXP PULSE	kWh export pulse
PLS.rE.i	kvarh IMP PULSE	kvarh import pulse
PLS.rE.E	kvarh EXP PULSE	kvarh export pulse
PLS.rE.t	kvarh TOT PULSE	kvarh total pulse
PLS.AP.t	kVAh TOT PULSE	kVAh total pulse
PLS.P.dn	START DMD INT	Start new demand interval
PLS.S.dn	START SD INT	Start new sliding window demand interval
PLS.A.dn	START AMP DMD INT	Start new volt/ampere demand interval
PLS.trF	START TARIFF INT	Start new tariff interval
		Pulse Counters
Cnt.1	HI COUNTER #1	High pulse counter #1
Cnt.2	HI COUNTER #2	High pulse counter #2
Cnt.3	HI COUNTER #3	High pulse counter #3
Cnt.4	HI COUNTER #4	High pulse counter #4
		Timers
t-r.1	TIMER #1	Timer #1
t-r.2	TIMER #2	Timer #2
t-r.3	TIMER #3	Timer #3
t-r.4	TIMER #4	Timer #4
		TOU Parameters
trF	TOU TARIFF	TOU Tariff
PrF	TOU PROFILE	TOU Profile
		Time and Date Parameters
U.dAY	DAY OF WEEK	Day of week
YEAr	YEAR	Year
Mon	MONTH	Month

Display Code	Designation	Description
M.dAY	DAY OF MONTH	Day of month
hour	HOURS	Hours
Min	MINUTES	Minutes
SEc	SECONDS	Seconds
		Event Flags
FG1.On	EVENT FLAG 1 ON	Event flag #1 ON
...	...	...
FG8.OFF	EVENT FLAG 8 OFF	Event flag #8 OFF
		Setpoint Status
SP1.On	SP 1 ON	Setpoint #1 ON
...	...	...
SP16.On	SP 16 ON	Setpoint #16 ON

7. [1] In 4LN3, 3LN3 and 3BLN3 wiring modes, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

Setpoint Actions

Display Code	Designation	Description
none	NONE	None (no action)
rEL.1	OPERATE RELAY #1	Operate RO1
rEL.2	OPERATE RELAY #2	Operate RO2
rEL1.OFF	RELEASE RELAY #1	Release latched RO1
rEL2.OFF	RELEASE RELAY #2	Release latched RO2
ELoG	EVENT LOG	Log to Event Log
dLoG.1	DATA LOG #1	Log to Data Log file #1
dLoG.2	DATA LOG #2	Log to Data Log file #2
dLoG.3	DATA LOG #3	Log to Data Log file #3
dLoG.4	DATA LOG #4	Log to Data Log file #4
dLoG.5	DATA LOG #5	Log to Data Log file #5
dLoG.6	DATA LOG #6	Log to Data Log file #6
dLoG.7	DATA LOG #7	Log to Data Log file #7
dLoG.8	DATA LOG #8	Log to Data Log file #8
dLoG.9	DATA LOG #9	Log to Data Log file #9
dLoG.10	DATA LOG #10	Log to Data Log file #10
dLoG.11	DATA LOG #11	Log to Data Log file #11
dLoG.12	DATA LOG #12	Log to Data Log file #12
dLoG.13	DATA LOG #13	Log to Data Log file #13
dLoG.14	DATA LOG #14	Log to Data Log file #14
dLoG.15	DATA LOG #15	Log to Data Log file #15
dLoG.16	DATA LOG #16	Log to Data Log file #16
ULoG.1	WAVEFORM LOG #1	Log to Waveform Log file #1
ULoG.2	WAVEFORM LOG #2	Log to Waveform Log file #2
Inc.Cn.1	INC CNT #1	Increment counter #1
Inc.Cn.2	INC CNT #2	Increment counter #2
Inc.Cn.3	INC CNT #3	Increment counter #3
Inc.Cn.4	INC CNT #4	Increment counter #4
CLr.Cn.1	CLR CNT #1	Clear counter #1
CLr.Cn.2	CLR CNT #2	Clear counter #2
CLr.Cn.3	CLR CNT #3	Clear counter #3
CLr.Cn.4	CLR CNT #4	Clear counter #4
CLr.Cnt	CLR ALL CNT	Clear all counters
CLr.Enr	CLR ENERGY	Clear total and phase energy accumulators
CLr.dnd	CLR ALL DMD	Clear all maximum demands
CLr.P.dn	CLR PWR DMD	Clear power maximum demands
CLr.A.dn	CLR VOLT/AMP/THD DMD	Clear volt, ampere and THD maximum demands
CLr.tEn	CLR TOU ENG	Clear TOU energy accumulators
CLr.tdn	CLR TOU DMD	Clear TOU maximum demands
CLr.LHi	CLR MIN/MAX	Clear Min/Max log
FLG1.On	SET FLAG #1	Set event flag #1
FLG2.On	SET FLAG #2	Set event flag #2
FLG3.On	SET FLAG #3	Set event flag #3
FLG4.On	SET FLAG #4	Set event flag #4
FLG1.OFF	CLR FLAG #1	Clear event flag #1

Display Code	Designation	Description
FLG2.OFF	CLR FLAG #2	Clear event flag #2
FLG3.OFF	CLR FLAG #3	Clear event flag #3
FLG4.OFF	CLR FLAG #4	Clear event flag #4

Appendix D Parameters for Monitoring and Data Logging

The following table lists parameters measured by the meter that are available for data logging and monitoring through communications. The left column shows data abbreviations used in PAS. Parameter groups are highlighted in bold.

Designation	Description
NONE	None (stub, read as zero)
EVENT FLAGS	**Event Flags**
EVENT FLAGS 1:16	Event Flags #1-#8
DIGITAL INPUTS	**Digital Inputs**
DI1:16	Digital Inputs Status DI1:DI2
RELAYS	**Relays**
RO1:16	Relay Status RO1:RO2
COUNTERS	**Pulse Counters**
COUNTER 1	Counter #1
COUNTER 2	Counter #2
COUNTER 3	Counter #3
COUNTER 4	Counter #4
SYMM COMP	**Symmetrical Components**
V PSEQ	Positive-sequence voltage
V NSEQ	Negative-sequence voltage
V ZSEQ	Zero-sequence voltage
V NSEQ UNB%	Negative-sequence voltage unbalance
V ZSEQ UNB%	Zero-sequence voltage unbalance
I PSEQ	Positive-sequence current
I NSEQ	Negative-sequence current
I ZSEQ	Zero-sequence current
I NSEQ UNB%	Negative-sequence current unbalance
I ZSEQ UNB%	Zero-sequence current unbalance
RT PHASE	**1-Cycle Phase Values**
V1	V1/V12 Voltage [1]
V2	V2/V23 Voltage [1]
V3	V3/V31 Voltage [1]
I1	I1 Current
I2	I2 Current
I3	I3 Current
kW L1	kW L1
kW L2	kW L2
kW L3	kW L3
kvar L1	kvar L1
kvar L2	kvar L2
kvar L3	kvar L3
kVA L1	kVA L1
kVA L2	kVA L2
kVA L3	kVA L3
PF L1	Power factor L1
PF L2	Power factor L2
PF L3	Power factor L3
V1 THD	V1/V12 Voltage THD [2]
V2 THD	V2/V23 Voltage THD [2]
V3 THD	V3/V31 Voltage THD [2]
I1 THD	I1 Current THD
I2 THD	I2 Current THD
I3 THD	I3 Current THD
I1 KF	I1 K-Factor
I2 KF	I2 K-Factor
I3 KF	I3 K-Factor
I1 TDD	I1 Current TDD
I2 TDD	I2 Current TDD

Designation	Description
I3 TDD	I3 Current TDD
V12	V12 Voltage
V23	V23 Voltage
V31	V31 Voltage
RT TOTAL	**1-Cycle Total Values**
kW	Total kW
kvar	Total kvar
kVA	Total kVA
PF	Total PF
PF LAG	Total PF lag
PF LEAD	Total PF lead
kW IMP	Total kW import
kW EXP	Total kW export
kvar IMP	Total kvar import
kvar EXP	Total kvar export
V AVG	3-phase average L-N/L-L voltage [1]
V LL AVG	3-phase average L-L voltage
I AVG	3-phase average current
RT AUX	**1-Cycle Auxiliary Values**
In	In (neutral) Current
FREQ	Frequency
V UNB%	Voltage unbalance
I UNB%	Current unbalance
AVR PHASE	**1-Second Phase Values**
V1	V1/V12 Voltage [1]
V2	V2/V23 Voltage [1]
V3	V3/V31 Voltage [1]
I1	I1 Current
I2	I2 Current
I3	I3 Current
kW L1	kW L1
kW L2	kW L2
kW L3	kW L3
kvar L1	kvar L1
kvar L2	kvar L2
kvar L3	kvar L3
kVA L1	kVA L1
kVA L2	kVA L2
kVA L3	kVA L3
PF L1	Power factor L1
PF L2	Power factor L2
PF L3	Power factor L3
V1 THD	V1/V12 Voltage THD [2]
V2 THD	V2/V23 Voltage THD [2]
V3 THD	V3/V31 Voltage THD [2]
I1 THD	I1 Current THD
I2 THD	I2 Current THD
I3 THD	I3 Current THD
I1 KF	I1 K-Factor
I2 KF	I2 K-Factor
I3 KF	I3 K-Factor
I1 TDD	I1 Current TDD
I2 TDD	I2 Current TDD
I3 TDD	I3 Current TDD
V12	V12 Voltage
V23	V23 Voltage
V31	V31 Voltage
AVR TOTAL	**1-Second Total Values**
kW	Total kW
kvar	Total kvar
kVA	Total kVA
PF	Total PF
PF LAG	Total PF lag
PF LEAD	Total PF lead
kW IMP	Total kW import

Designation	Description
kW EXP	Total kW export
kvar IMP	Total kvar import
kvar EXP	Total kvar export
V AVG	3-phase average L-N/L-L voltage [1]
V LL AVG	3-phase average L-L voltage
I AVG	3-phase average current
AVR AUX	**1-Second Auxiliary Values**
In	In (neutral) Current
FREQ	Frequency
V UNB%	Voltage unbalance
I UNB%	Current unbalance
RMS (10-min)	**10-min Volts and Symmetrical Components**
V1	V1/V12 Voltage [2]
V2	V2/V23 Voltage [2]
V3	V3/V31 Voltage [2]
V ZERO-SEQ	Zero-sequence voltage
I ZERO-SEQ	Zero-sequence current
V UNB%	Negative-sequence voltage unbalance
I UNB%	Negative-sequence current unbalance
HRM TOT (10-min)	**10-min Total Harmonics**
V1 THD	V1/V12 Voltage THD [2]
V2 THD	V2/V23 Voltage THD [2]
V3 THD	V3/V31 Voltage THD [2]
I1 THD	I1 Current THD
I2 THD	I2 Current THD
I3 THD	I3 Current THD
V1 THD/I	V1/V12 Interharmonic voltage THD [2]
V2 THD/I	V2/V23 Interharmonic voltage THD [2]
V3 THD/I	V3/V31 Interharmonic voltage THD [2]
I1 TDD	I1 Current TDD
I2 TDD	I2 Current TDD
I3 TDD	I3 Current TDD
PHASORS	**Phasors**
V1 Mag	V1/V12 Voltage magnitude [2]
V2 Mag	V2/V23 Voltage magnitude [2]
V3 Mag	V3/V31 Voltage magnitude [2]
I1 Mag	I1 Current magnitude
I2 Mag	I2 Current magnitude
I3 Mag	I3 Current magnitude
V1 Ang	V1/V12 Voltage angle [2]
V2 Ang	V2/V23 Voltage angle [2]
V3 Ang	V3/V31 Voltage angle [2]
I1 Ang	I1 Current angle
I2 Ang	I2 Current angle
I3 Ang	I3 Current angle
DEMANDS	**Present Demands**
V1 DMD	V1/V12 Volt demand [2]
V2 DMD	V2/V23 Volt demand [2]
V3 DMD	V3/V31 Volt demand [2]
I1 DMD	I1 Ampere demand
I2 DMD	I2 Ampere demand
I3 DMD	I3 Ampere demand
kW IMP BD	kW import block demand
kvar IMP BD	kvar import block demand
kVA BD	kVA block demand
kW IMP SD	kW import sliding window demand
kvar IMP SD	kvar import sliding window demand
kVA SD	kVA sliding window demand
kW IMP ACC DMD	kW import accumulated demand
kvar IMP ACC DMD	kvar import accumulated demand
kVA ACC DMD	kVA accumulated demand
kW IMP PRD DMD	kW import predicted sliding window demand
kvar IMP PRD DMD	kvar import predicted sliding window demand

Designation	Description
kVA PRD DMD	kVA predicted sliding window demand
PF IMP@kVA MXDMD	PF (import) at Maximum kVA sliding window demand
kW EXP BD	kW export block demand
kvar EXP BD	kvar export block demand
kW EXP SD	kW export sliding window demand
kvar EXP SD	kvar export sliding window demand
kW EXP ACC DMD	kW export accumulated demand
kvar EXP ACC DMD	kvar export accumulated demand
kW EXP PRD DMD	kW export predicted sliding window demand
kvar EXP PRD DMD	kvar export predicted sliding window demand
HRM DMD	**Present Harmonic Demands**
V1 THD DMD	V1/V12 THD demand [2]
V2 THD DMD	V2/V23 THD demand [2]
V3 THD DMD	V3/V31 THD demand [2]
I1 THD DMD	I1 THD demand
I2 THD DMD	I2 THD demand
I3 THD DMD	I3 THD demand
I1 TDD DMD	I1 TDD demand
I2 TDD DMD	I2 TDD demand
I3 TDD DMD	I3 TDD demand
SUMM ACC DMD	**Summary (TOU Total) Accumulated Demands**
SUM REG1 ACC DMD	Summary register #1 demand
SUM REG2 ACC DMD	Summary register #2 demand
...	...
SUM REG8 ACC DMD	Summary register #8 demand
SUMM BLK DMD	**Summary (TOU Total) Block Demands**
SUM REG1 BLK DMD	Summary register #1 demand
SUM REG2 BLK DMD	Summary register #2 demand
...	...
SUM REG8 BLK DMD	Summary register #8 demand
SUMM SW DMD	**Summary (TOU Total) Sliding Demands**
SUM REG1 SW DMD	Summary register #1 demand
SUM REG2 SW DMD	Summary register #2 demand
...	...
SUM REG8 SW DMD	Summary register #8 demand
ENERGY	**Total Energy**
kWh IMPORT	kWh import
kWh EXPORT	kWh export
kvarh IMPORT	kvarh import
kvarh EXPORT	kvarh export
kVAh TOTAL	kVAh total
SUMMARY REGS	**Summary (TOU Total) Energy Registers**
SUM REG1	Summary energy register #1
SUM REG2	Summary energy register #2
...	...
SUM REG8	Summary energy register #8
PHASE ENERGY	**Phase Energy**
kWh IMP L1	kWh import L1
kWh IMP L2	kWh import L2
kWh IMP L3	kWh import L3
kvarh IMP L1	kvarh import L1
kvarh IMP L2	kvarh import L2
kvarh IMP L3	kvarh import L3
kVAh L1	kVAh total L1
kVAh L2	kVAh total L2
kVAh L3	kVAh total L3
%HD V1	**V1/V12 Harmonic Distortions** [2]
V1 %HD01	H01 Harmonic distortion
V1 %HD02	H02 Harmonic distortion
...	...
V1 %HD50	H50 Harmonic distortion
%HD V2	**V2/V23 Harmonic Distortions** [2]
V2 %HD01	H01 Harmonic distortion
V2 %HD02	H02 Harmonic distortion
...	...

Designation	Description
V2 %HD50	H50 Harmonic distortion
%HD V3	**V3/V31 Harmonic Distortions** [2]
V3 %HD01	H01 Harmonic distortion
V3 %HD02	H02 Harmonic distortion
...	...
V3 %HD50	H50 Harmonic distortion
%HD I1	**I1 Harmonic Distortions**
I1 %HD01	H01 Harmonic distortion
I1 %HD02	H02 Harmonic distortion
...	...
I1 %HD50	H50 Harmonic distortion
%HD I2	**I2 Harmonic Distortions**
I2 %HD01	H01 Harmonic distortion
I2 %HD02	H02 Harmonic distortion
...	...
I2 %HD50	H50 Harmonic distortion
%HD I3	**I3 Harmonic Distortions**
I3 %HD01	H01 Harmonic distortion
I3 %HD02	H02 Harmonic distortion
...	...
I3 %HD50	H50 Harmonic distortion
ANG V1	**V1/V12 Harmonic Angles** [2]
V1 H01 ANG	H01 Harmonic angle
V1 H02 ANG	H02 Harmonic angle
...	...
V1 H50 ANG	H50 Harmonic angle
ANG V2	**V2/V23 Harmonic Angles** [2]
V2 H01 ANG	H01 Harmonic angle
V2 H02 ANG	H02 Harmonic angle
...	...
V2 H50 ANG	H50 Harmonic angle
ANG V3	**V3/V31 Harmonic Angles** [2]
V3 H01 ANG	H01 Harmonic angle
V3 H02 ANG	H02 Harmonic angle
...	...
V3 H50 ANG	H40 Harmonic angle
ANG I1	**I1 Harmonic Angles**
I1 H01 ANG	H01 Harmonic angle
I1 H02 ANG	H02 Harmonic angle
...	...
I1 H50 ANG	H50 Harmonic angle
ANG I2	**I2 Harmonic Angles**
I2 H01 ANG	H01 Harmonic angle
I2 H02 ANG	H02 Harmonic angle
...	...
I2 H50 ANG	H50 Harmonic angle
ANG I3	**I3 Harmonic Angles**
I3 H01 ANG	H01 Harmonic angle
I3 H02 ANG	H02 Harmonic angle
...	...
I3 H50 ANG	H50 Harmonic angle
H1 PHASE	**Fundamental (H01) Phase Values**
V1 H01	V1/V12 Voltage [2]
V2 H01	V2/V23 Voltage [2]
V3 H01	V3/V31 Voltage [2]
I1 H01	I1 Current
I2 H01	I2 Current
I3 H01	I3 Current
kW L1 H01	kW L1
kW L2 H01	kW L2
kW L3 H01	kW L3
kvar L1 H01	kvar L1
kvar L2 H01	kvar L2
kvar L3 H01	kvar L3
kVA L1 H01	kVA L1

Designation	Description
kVA L2 H01	kVA L2
kVA L3 H01	kVA L3
PF L1 H01	Power factor L1
PF L2 H01	Power factor L2
PF L3 H01	Power factor L3
HRM TOT POW	**Fundamental Total Power Values**
kW H01	Total fundamental kW
kvar H01	Total fundamental kvar
kVA H01	Total fundamental kVA
PF H01	Total fundamental PF
FLICKER	**Flicker** [2]
V1 Pst	V1 short-term (10 min) flicker severity
V2 Pst	V2 short-term (10 min) flicker severity
V3 Pst	V3 short-term (10 min) flicker severity
V1 Plt	V1 long-term (2 hours) flicker severity
V2 Plt	V2 long-term (2 hours) flicker severity
V3 Plt	V3 long-term (2 hours) flicker severity
MIN PHASE	**Minimum 1-Cycle Phase Values**
V1 MIN	V1/V12 Voltage [2]
V2 MIN	V2/V23 Voltage [2]
V3 MIN	V3/V31 Voltage [2]
I1 MIN	I1 Current
I2 MIN	I2 Current
I3 MIN	I3 Current
V1 THD MIN	V1/V12 Voltage THD [2]
V2 THD MIN	V2/V23 Voltage THD [2]
V3 THD MIN	V3/V31 Voltage THD [2]
I1 THD MIN	I1 Current THD
I2 THD MIN	I2 Current THD
I3 THD MIN	I3 Current THD
I1 KF MIN	I1 K-Factor
I2 KF MIN	I2 K-Factor
I3 KF MIN	I3 K-Factor
I1 TDD MIN	I1 Current TDD
I2 TDD MIN	I2 Current TDD
I3 TDD MIN	I3 Current TDD
MIN TOTAL	**Minimum 1-Cycle Total Values**
kW MIN	Total kW
kvar MIN	Total kvar
kVA MIN	Total kVA
PF MIN	Total PF
MIN AUX	**Minimum 1-Cycle Auxiliary Values**
In MIN	In Current
FREQ MIN	Frequency
MAX PHASE	**Maximum 1-Cycle Phase Values**
V1 MAX	V1/V12 Voltage [2]
V2 MAX	V2/V23 Voltage [2]
V3 MAX	V3/V31 Voltage [2]
I1 MAX	I1 Current
I2 MAX	I2 Current
I3 MAX	I3 Current
V1 THD MAX	V1/V12 Voltage THD [2]
V2 THD MAX	V2/V23 Voltage THD [2]
V3 THD MAX	V3/V31 Voltage THD [2]
I1 THD MAX	I1 Current THD
I2 THD MAX	I2 Current THD
I3 THD MAX	I3 Current THD
I1 KF MAX	I1 K-Factor
I2 KF MAX	I2 K-Factor
I3 KF MAX	I3 K-Factor
I1 TDD MAX	I1 Current TDD
I2 TDD MAX	I2 Current TDD
I3 TDD MAX	I3 Current TDD
MAX TOTAL	**Maximum 1-Cycle Total Values**

Designation	Description
kW MAX	Total kW
kvar MAX	Total kvar
kVA MAX	Total kVA
PF MAX	Total PF
MAX AUX	**Maximum 1-Cycle Auxiliary Values**
In MAX	In Current
FREQ MAX	Frequency
MAX DMD	**Maximum Demands**
V1 DMD MAX	V1/V12 Maximum volt demand [2]
V2 DMD MAX	V2/V23 Maximum volt demand [2]
V3 DMD MAX	V3/V31 Maximum volt demand [2]
I1 DMD MAX	I1 Maximum ampere demand
I2 DMD MAX	I2 Maximum ampere demand
I3 DMD MAX	I3 Maximum ampere demand
kW IMP SD MAX	Maximum kW import sliding window demand
kW EXP SD MAX	Maximum kvar import sliding window demand
kvar IMP SD MAX	Maximum kW export sliding window demand
kvar EXP SD MAX	Maximum kvar export sliding window demand
kVA SD MAX	Maximum kVA sliding window demand
MAX HRM DMD	**Maximum Harmonic Demands**
V1 THD DMD MAX	V1/V12 THD demand [2]
V2 THD DMD MAX	V2/V23 THD demand [2]
V3 THD DMD MAX	V3/V31 THD demand [2]
I1 THD DMD MAX	I1 THD demand
I2 THD DMD MAX	I2 THD demand
I3 THD DMD MAX	I3 THD demand
I1 TDD DMD MAX	I1 TDD demand
I2 TDD DMD MAX	I2 TDD demand
I3 TDD DMD MAX	I3 TDD demand
MAX SUMMARY DMD	**Maximum Summary (TOU Total) Demands**
SUM REG1 DMD MAX	Summary register #1 maximum demand
SUM REG2 DMD MAX	Summary register #2 maximum demand
...	...
SUM REG8 DMD MAX	Summary register #8 maximum demand
ANALOG INPUTS	**Scaled Analog Inputs (Engineering Units)**
AI1	Analog input AI1
AI2	Analog input AI2
AI RAW	**Raw Analog Inputs (A/D Units)**
AI1 RAW	Analog input AI1
AI2 RAW	Analog input AI2
AO RAW	**Raw Analog Outputs (A/D Units)**
AO1	Analog output AO1
AO2	Analog output AO2
TOU PRMS	**TOU Parameters**
ACTIVE TARIFF	Active TOU tariff
ACTIVE PROFILE	Active TOU profile
TOU REG1	**TOU Energy Register #1**
TOU REG1 TRF1	Tariff #1 register
TOU REG1 TRF2	Tariff #2 register
...	...
TOU REG1 TRF8	Tariff #8 register
TOU REG2	**TOU Energy Register #2**
TOU REG2 TRF1	Tariff #1 register
TOU REG2 TRF2	Tariff #2 register
...	...
TOU REG2 TRF8	Tariff #8 register
TOU REG3	**TOU Energy Register #3**
TOU REG3 TRF1	Tariff #1 register
TOU REG3 TRF2	Tariff #2 register
...	...
TOU REG3 TRF8	Tariff #8 register
TOU REG4	**TOU Energy Register #4**
TOU REG4 TRF1	Tariff #1 register
TOU REG4 TRF2	Tariff #2 register
...	...

Designation	Description
TOU REG4 TRF8	Tariff #8 register
TOU REG5	**TOU Energy Register #5**
TOU REG5 TRF1	Tariff #1 register
TOU REG5 TRF2	Tariff #2 register
...	...
TOU REG5 TRF8	Tariff #8 register
TOU REG6	**TOU Energy Register #6**
TOU REG6 TRF1	Tariff #1 register
TOU REG6 TRF2	Tariff #2 register
...	...
TOU REG6 TRF8	Tariff #8 register
TOU REG7	**TOU Energy Register #7**
TOU REG7 TRF1	Tariff #1 register
TOU REG7 TRF2	Tariff #2 register
...	...
TOU REG7 TRF8	Tariff #8 register
TOU REG8	**TOU Energy Register #8**
TOU REG8 TRF1	Tariff #1 register
TOU REG8 TRF2	Tariff #2 register
...	...
TOU REG8 TRF8	Tariff #8 register
TOU MAX DMD REG1	**TOU Maximum Demand Register #1**
DMD1 TRF1 MAX	Tariff #1 register
DMD1 TRF2 MAX	Tariff #2 register
...	...
DMD1 TRF8 MAX	Tariff #8 register
TOU MAX DMD REG2	**TOU Maximum Demand Register #2**
DMD2 TRF1 MAX	Tariff #1 register
DMD2 TRF2 MAX	Tariff #2 register
...	...
DMD2 TRF8 MAX	Tariff #8 register
TOU MAX DMD REG3	**TOU Maximum Demand Register #3**
DMD3 TRF1 MAX	Tariff #1 register
DMD3 TRF2 MAX	Tariff #2 register
...	...
DMD3 TRF8 MAX	Tariff #8 register
TOU MAX DMD REG4	**TOU Maximum Demand Register #4**
DMD4 TRF1 MAX	Tariff #1 register
DMD4 TRF2 MAX	Tariff #2 register
...	...
DMD4 TRF8 MAX	Tariff #8 register
TOU MAX DMD REG5	**TOU Maximum Demand Register #5**
DMD5 TRF1 MAX	Tariff #1 register
DMD5 TRF2 MAX	Tariff #2 register
...	...
DMD5 TRF8 MAX	Tariff #8 register
TOU MAX DMD REG6	**TOU Maximum Demand Register #6**
DMD6 TRF1 MAX	Tariff #1 register
DMD6 TRF2 MAX	Tariff #2 register
...	...
DMD6 TRF8 MAX	Tariff #8 register
TOU MAX DMD REG7	**TOU Maximum Demand Register #7**
DMD7 TRF1 MAX	Tariff #1 register
DMD7 TRF2 MAX	Tariff #2 register
...	...
DMD7 TRF8 MAX	Tariff #8 register
TOU MAX DMD REG8	**TOU Maximum Demand Register #8**
DMD8 TRF1 MAX	Tariff #1 register
DMD8 TRF2 MAX	Tariff #2 register
...	...
DMD8 TRF8 MAX	Tariff #8 register

[1] In 4LN3, 4LL3, 3LN3, 3LL3, 3BLN3 and 3BLL3 wiring modes, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

[2] In 4LN3, 3LN3 and 3BLN3 wiring modes, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line.

Appendix E EN50160 Statistics Log Files

The following table lists the EN50160 evaluation parameters recorded by the meter in the EN50160 statistics data log files. The second column shows data abbreviations used in the PAS data log reports. Data log files' sections are highlighted by a bold font.

EN50160 Compliance Statistics Log (Data Log #9)

Field No.	Designation	Description
		Power Frequency
1	Nnv	Number of non-valid 10-sec intervals
2	N	Number of valid 10-sec intervals
3	N1	Number of incidents ±1%, N1
4	N2	Number of incidents +4%/-6%, N2
5	N1/N, %	EN50160 compliance ratio, N1/N
6	N2/N, %	EN50160 compliance ratio, N2/N
7	Freq Min	Minimum frequency
8	Freq Max	Maximum frequency
		Supply Voltage Variations
1	Nnv	Number of non-valid 10-min intervals
2	N	Number of valid 10-min intervals
3	N1	Number of polyphase incidents ±10%, N1
4	N2	Number of polyphase incidents +10/-15%, N2
5	N1/N, %	EN50160 compliance ratio, N1/N
6	N2/N, %	EN50160 compliance ratio, N2/N
7	V1 N1	Number of incidents ±10% on phase V1
8	V1 Min	Minimum voltage on phase V1
9	V1 Max	Maximum voltage on phase V1
10	V2 N1	Number of incidents ±10% on phase V2
11	V2 Min	Minimum voltage on phase V2
12	V2 Max	Maximum voltage on phase V2
13	V3 N1	Number of incidents ±10% on phase V3
14	V3 Min	Minimum voltage on phase V3
15	V3 Max	Maximum voltage on phase V3
		Rapid Voltage Changes
1	N1	Number of polyphase incidents
2	V1 N1	Number of incidents on phase V1
3	V1 dV%	Maximum voltage variation on phase V1, dV/Un%
4	V2 N1	Number of incidents on phase V2
5	V2 dV%	Maximum voltage variation on phase V2, dV/Un%
6	V3 N1	Number of incidents on phase V3
7	V3 dV%	Maximum voltage variation on phase V3, dV/Un%
		Flicker
1	Nnv	Number of non-valid 10-min intervals
2	N	Number of valid 10-min intervals
3	N1	Number of polyphase incidents Plt >1%, N1
4	N1/N, %	EN50160 compliance ratio, N1/N
5	V1 N1	Number of incidents Plt > 1% on phase V1
6	V1 Plt Max	Maximum Plt on phase V2
7	V2 N1	Number of incidents Plt > 1% on phase V2
8	V2 Plt Max	Maximum Plt on phase V2
9	V3 N1	Number of incidents Plt > 1% on phase V3
10	V3 Plt Max	Maximum Plt on phase V3
		Voltage Dips (indicative statistics)
1	N11 90%/100ms	Number of polyphase incidents u<90%/t<100ms
2	N12 85%/100ms	Number of polyphase incidents u<85%/t<100ms
3	N13 70%/100ms	Number of polyphase incidents u<70%/t<100ms
4	N14 40%/100ms	Number of polyphase incidents u<40%/t<100ms
5	N11 90%/500ms	Number of polyphase incidents u<90%/t<500ms
6	N12 85%/500ms	Number of polyphase incidents u<85%/t<500ms
7	N13 70%/500ms	Number of polyphase incidents u<70%/t<500ms
8	N14 40%/500ms	Number of polyphase incidents u<40%/t<500ms
9	N11 90%/1s	Number of polyphase incidents u<90%/t<1s

Field No.	Designation	Description
10	N12 85%/1s	Number of polyphase incidents u<85%/t<1s
11	N13 70%/1s	Number of polyphase incidents u<70%/t<1s
12	N14 40%/1s	Number of polyphase incidents u<40%/t<1s
13	N11 90%/3s	Number of polyphase incidents u<90%/t<3s
14	N12 85%/3s	Number of polyphase incidents u<85%/t<3s
15	N13 70%/3s	Number of polyphase incidents u<70%/t<3s
16	N14 40%/3s	Number of polyphase incidents u<40%/t<3s
17	N11 90%/20s	Number of polyphase incidents u<90%/t<20s
18	N12 85%/20s	Number of polyphase incidents u<85%/t<20s
19	N13 70%/20s	Number of polyphase incidents u<70%/t<20s
20	N14 40%/20s	Number of polyphase incidents u<40%/t<20s
21	N11 90%/60s	Number of polyphase incidents u<90%/t<60s
22	N12 85%/60s	Number of polyphase incidents u<85%/t<60s
23	N13 70%/60s	Number of polyphase incidents u<70%/t<60s
24	N14 40%/60s	Number of polyphase incidents u<40%/t<60s
25	N11 90%/180s	Number of polyphase incidents u<90%/t<180s
26	N12 85%/180s	Number of polyphase incidents u<85%/t<180s
27	N13 70%/180s	Number of polyphase incidents u<70%/t<180s
28	N14 40%/180s	Number of polyphase incidents u<40%/t<180s
29	V1 N1	Total number of incidents on phase V1
30	V1 Min	Minimum residual voltage on phase V1
31	V2 N1	Total number of incidents on phase V2
32	V2 Min	Minimum residual voltage on phase V2
33	V3 N1	Total number of incidents on phase V3
34	V3 Min	Minimum residual voltage on phase V3
		Voltage Interruptions (indicative statistics)
1	N1 1s	Number of polyphase incidents t<1s
2	N2 180s	Number of polyphase incidents t<180s
3	N3 >180s	Number of polyphase incidents t>180s
4	V1 Min	Minimum residual voltage on phase V1
5	V2 Min	Minimum residual voltage on phase V2
6	V3 Min	Minimum residual voltage on phase V3
		Temporary Overvoltages (indicative statistics)
1	N11 110%/1s	Number of polyphase incidents u>110%/t<1s
2	N12 120%/1s	Number of polyphase incidents u>120%/t<1s
3	N13 140%/1s	Number of polyphase incidents u>140%/t<1s
4	N14 160%/1s	Number of polyphase incidents u>160%/t<1s
5	N15 200%/1s	Number of polyphase incidents u>200%/t<1s
6	N21 110%/60s	Number of polyphase incidents u>110%/t<60s
7	N22 120%/60s	Number of polyphase incidents u>120%/t<60s
8	N23 140%/60s	Number of polyphase incidents u>140%/t<60s
9	N24 160%/60s	Number of polyphase incidents u>160%/t<60s
10	N25 200%/60s	Number of polyphase incidents u>200%/t<60s
11	N31 110%/>60s	Number of polyphase incidents u>110%/t>60s
12	N32 120%/>60s	Number of polyphase incidents u>120%/t>60s
13	N33 140%/>60s	Number of polyphase incidents u>140%/t>60s
14	N34 160%/>60s	Number of polyphase incidents u>160%/t>60s
15	N35 200%/>60s	Number of polyphase incidents u>200%/t>60s
16	V1 N1	Total number of incidents on phase V1
17	V1 Max	Maximum voltage magnitude on phase V1
18	V2 N1	Total number of incidents on phase V2
19	V2 Max	Maximum voltage magnitude on phase V2
20	V3 N1	Total number of incidents on phase V3
21	V3 Max	Maximum voltage magnitude on phase V3
		Transient Overvoltages (indicative statistics)
1	N1 110%	Number of polyphase incidents u>120%
2	N2 150%	Number of polyphase incidents u>150%
3	N3 200%	Number of polyphase incidents u>200%
4	N4 250%	Number of polyphase incidents u>250%
5	N5 300%	Number of polyphase incidents u>300%
6	V1 N1 110%	Number of incidents u>120% on phase V1
7	V1 N2 150%	Number of incidents u>150% on phase V1
8	V1 N3 200%	Number of incidents u>200% on phase V1
9	V1 N4 250%	Number of incidents u>250% on phase V1
10	V1 N5 300%	Number of incidents u>300% on phase V1
11	V2 N1 110%	Number of incidents u>120% on phase V2

Field No.	Designation	Description
12	V2 N2 150%	Number of incidents u>150% on phase V2
13	V2 N3 200%	Number of incidents u>200% on phase V2
14	V2 N4 250%	Number of incidents u>250% on phase V2
15	V2 N5 300%	Number of incidents u>300% on phase V2
16	V3 N1 110%	Number of incidents u>120% on phase V3
17	V3 N2 150%	Number of incidents u>150% on phase V3
18	V3 N3 200%	Number of incidents u>200% on phase V3
19	V3 N4 250%	Number of incidents u>250% on phase V3
20	V3 N5 300%	Number of incidents u>300% on phase V3
21	V1 Peak Max	Maximum peak voltage on phase V1
22	V2 Peak Max	Maximum peak voltage on phase V2
23	V3 Peak Max	Maximum peak voltage on phase V3
		Supply Voltage Unbalance
1	Nnv	Number of non-valid 10-min intervals
2	N	Number of valid 10-min intervals
3	N1	Number of incidents V Unb > 2%, N1
4	N1/N, %	EN50160 compliance ratio, N1/N
5	V Unb% Max	Maximum voltage unbalance
		Harmonic Voltage
1	Nnv	Number of non-valid 10-min intervals
2	N	Number of valid 10-min intervals
3	N1	Number of polyphase harmonic voltage incidents, N1
4	N2	Number of polyphase voltage THD incidents, N2
5	N1/N, %	EN50160 harmonic voltage compliance ratio, N1/N
6	N2/N, %	EN50160 voltage THD compliance ratio, N2/N
7	V1 N1	Number of harmonic voltage incidents on phase V1
8	V1 N2	Number of voltage THD incidents on phase V1
9	V1 HD% Max	Worst-case harmonic magnitude on phase V1, %Un
10	V1 H#	Worst-case harmonic component number on phase V1
11	V1 THD Max	Worst-case voltage THD on phase V1
12	V2 N1	Number of harmonic voltage incidents on phase V2
13	V2 N2	Number of voltage THD incidents on phase V2
14	V2 HD% Max	Worst-case harmonic magnitude on phase V2, %Un
15	V2 H#	Worst-case harmonic component number on phase V2
16	V2 THD Max	Worst-case voltage THD on phase V2
17	V3 N1	Number of harmonic voltage incidents on phase V3
18	V3 N2	Number of voltage THD incidents on phase V3
19	V3 HD% Max	Worst-case harmonic magnitude on phase V3, %Un
20	V3 H#	Worst-case harmonic component number on phase V3
21	V3 THD Max	Worst-case voltage THD on phase V3
		Interharmonic Voltage
1	Nnv	Number of non-valid 10-min intervals
2	N	Number of valid 10-min intervals
3	N1	Number of polyphase interharmonic voltage incidents, N1
4	N2	Number of polyphase interharmonic THD incidents, N2
5	N1/N, %	EN50160 interharmonic voltage compliance ratio, N1/N
6	N2/N, %	EN50160 interharmonic voltage THD compliance ratio, N2/N
7	V1 N1	Number of interharmonic voltage incidents on phase V1
8	V1 N2	Number of interharmonic voltage THD incidents on phase V1
9	V1 HD% Max	Worst-case interharmonic magnitude on phase V1, %Un
10	V1 H#	Worst-case interharmonic component number on phase V1
11	V1 THD Max	Worst-case interharmonic voltage THD on phase V1
12	V2 N1	Number of interharmonic voltage incidents on phase V2
13	V2 N2	Number of interharmonic voltage THD incidents on phase V2
14	V2 HD% Max	Worst-case interharmonic magnitude on phase V2, %Un
15	V2 H#	Worst-case interharmonic component number on phase V2
16	V2 THD Max	Worst-case interharmonic voltage THD on phase V2
17	V3 N1	Number of interharmonic voltage incidents on phase V3
18	V3 N2	Number of interharmonic voltage THD incidents on phase V3
19	V3 HD% Max	Worst-case interharmonic magnitude on phase V3, %Un
20	V3 H#	Worst-case interharmonic component number on phase V3
21	V3 THD Max	Worst-case interharmonic THD on phase V3
		Mains Signaling Voltage
1	Nnv	Number of non-valid 3-sec intervals
2	N	Number of valid 3-sec intervals
3	N1	Number of polyphase incidents, N1

Field No.	Designation	Description
4	N1/N, %	EN50160 compliance ratio, N1/N
5	V1 N1	Number of incidents on phase V1
6	V1 Frq1 %Un	Maximum 1st signaling voltage magnitude on phase V1, %Un
7	V1 Frq2 %Un	Maximum 2nd signaling voltage magnitude on phase V1, %Un
8	V1 Frq3 %Un	Maximum 3rd signaling voltage magnitude on phase V1, %Un
9	V1 Frq4 %Un	Maximum 4th signaling voltage magnitude on phase V1, %Un
10	V2 N1	Number of incidents on phase V2
11	V2 Frq1 %Un	Maximum 1st signaling voltage magnitude on phase V2, %Un
12	V2 Frq2 %Un	Maximum 2nd signaling voltage magnitude on phase V2, %Un
13	V2 Frq3 %Un	Maximum 3rd signaling voltage magnitude on phase V2, %Un
14	V2 Frq4 %Un	Maximum 4th signaling voltage magnitude on phase V2, %Un
15	V3 N1	Number of incidents on phase V3
16	V3 Frq1 %Un	Maximum 1st signaling voltage magnitude on phase V3, %Un
17	V3 Frq2 %Un	Maximum 2nd signaling voltage magnitude on phase V3, %Un
18	V3 Frq3 %Un	Maximum 3rd signaling voltage magnitude on phase V3, %Un
19	V3 Frq4 %Un	Maximum 4th signaling voltage magnitude on phase V3, %Un
20	Frq1	1st signaling voltage frequency
21	Frq2	2nd signaling voltage frequency
22	Frq3	3rd signaling voltage frequency
23	Frq4	4th signaling voltage frequency

EN50160 Harmonics Survey Log (Data Log #10)

Field No.	Designation	Description
		V1 Harmonic Voltage
1	THD MAX	Maximum THD
2	THDO MAX	Maximum odd harmonics THD
3	THDE MAX	Maximum even harmonics THD
4	%HD02 MAX	Maximum H02 harmonic voltage magnitude, %Un
5	%HD03 MAX	Maximum H03 harmonic voltage magnitude, %Un
...	...	
51	%HD50 MAX	Maximum H50 harmonic voltage magnitude, %Un
		V2 Harmonic Voltage
1	THD MAX	Maximum THD
2	THDO MAX	Maximum odd harmonics THD
3	THDE MAX	Maximum even harmonics THD
4	%HD02 MAX	Maximum H02 harmonic voltage magnitude, %Un
5	%HD03 MAX	Maximum H03 harmonic voltage magnitude, %Un
...	...	
51	%HD50 MAX	Maximum H50 harmonic voltage magnitude, %Un
		V3 Harmonic Voltage
1	THD MAX	Maximum THD
2	THDO MAX	Maximum odd harmonics THD
3	THDE MAX	Maximum even harmonics THD
4	%HD02 MAX	Maximum H02 harmonic voltage magnitude, %Un
5	%HD03 MAX	Maximum H03 harmonic voltage magnitude, %Un
...	...	
51	%HD50 MAX	Maximum H50 harmonic voltage magnitude, %Un